THE

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LONDON'S ELECTRICITY SUPPLY.

IT is somewhat appropriate at the present time, when the question of the future of London's electricity supply is so prominently before the public, that attention should be directed to the position of the latter, as represented by the electricity consumer, under present and possible future conditions of supply.

We publish elsewhere a letter bearing on this matter which reflects, to some extent, the opinion held in certain quarters that the London consumer is well off in comparison with the electrical user in European cities.

It would seem that the writer, who represents the company interests, is satisfied with the present position of affairs, but it is only right to point out that the average figures which he gives benefit considerably from the inclusion of the lower priced units supplied by the municipal undertakings, as will be shown below.

The report of Messrs. Merz & McLellan to the L.C.C. should serve to remove a good deal of the obscurity which has surrounded the possible municipalisation of supply in the Metropolitan area.

It will be readily admitted that for it to achieve ultimate success, any scheme which aims directly or indirectly at the unification of electricity supply in London must inspire confidence in the consumer, and the latter may find some food for thought in the L.C.C. returns relating to London's electricity supply during 1911-12; and if past records afford any indication of future prospects, possibly some idea may be gained from them as to whether private or municipal control, or some form of control which combines the advantages of both without their disadvantages, would be the best solution of the problem.

These returns dealt with 15 municipal and 13 private undertakings in London, and 24 municipal and 15 private extra-London undertakings.

For the moment it is only necessary to consider electricity supply in the London area and to take the figures as they stand for 1911-12 in comparison with those of six years earlier. These are tabulated below:—

	1911-12.	Position as compared with 1905-6.
NET CAPITAL EXPENDITURE.		
Municipal	£6,581,198	+ 20 %
Private	£14,437,257	+ 13½ %
REVENUE.		
Municipal	£795,150	+ 53·7 %
Private	£1,731,907	+ 4 %
INTEREST AND DIVIDENDS.		
Municipal	£199,706	+ 22 %
Private	£732,577	− 2 %
PLANT CAPACITY.		
Municipal	80,603 KW.	+ 53 %
Private	153,479 KW.	+ 19·8 %
UNITS SOLD.		
Municipal	96 865,278	+ 125 %
Private	160,697,495	+ 34½ %

It will be seen that while the increase of municipal expenditure has exceeded the increase of private expenditure by some 6½ per cent. during the period under consideration,

the increased revenue derived from this expenditure by the municipal undertakings has been nearly 50 per cent. in excess of that derived by the private undertakings—the output of the municipal concerns having increased by 125 per cent., as compared with an increase of only 34½ per cent. on the part of the private undertakings.

With or without good reason, these figures, as an indication of six years' progress, are not favourable to the private companies.

The municipal undertakings obtained a smaller average price for their output, the figures being as follows :—

Average prices obtained.	Municipal.	Private.
Street lighting	1·52d.	1·43d.
Private lighting	3·15d.	3·55d.
Power	1·03d.	1·25d.
Combined av., all purposes ...	1·97d.	2·58d.

From the consumer's point of view, this is an important feature of the returns, and especially so in view of its influence on the development of electricity supply, although we are free to admit that increased sales might be attributable equally as much to business organisation and salesmanship as to price in some instances.

Price and efficiency of service rendered are the dominating factors so far as the consumer is concerned, and it is not illogical to assume that the comparatively greater progress of the municipal undertakings is due to a lead in both these directions, the competition of gas being equally felt all over the metropolis by both company and municipality, thanks to the splendid organisation of the gas interests.

The return gives the combined average prices obtained by municipal and company suppliers as 1·97d. and 2·58d., and the difference of ·61d. per unit paid by company consumers on the 160 million units credited to private undertakings may be taken as a measure of the extra cost of unrestricted private control.

Neglecting Stoke Newington, a minor undertaking, the highest average in the municipal list is the 3·17d. of Marylebone, while half a dozen companies exceed this figure, the highest average price for a private concern being over 4½d. per unit.

The increasing cost of fuel and domestic labour point to the necessity of many households introducing electrical power devices and electric heating, if only as a means of getting through more work in a given time, and quite apart from the hygienic question.

Looking more closely into the question of the future, and of any great extension of electricity supply, it is obvious that the smaller consumer will play a much more important part than he does now, and to such the initial price of energy* is of far more moment than the average price, which, indeed, means absolutely nothing to a consumer who is likely to be of the short-hour class.

We speak of "smaller consumer" in a strictly comparative sense, for there are thousands of dwelling houses in the London area, of rentals round about £40 to £50, some even fully wired in anticipation of electric lighting, which, in the companies' areas, use gas simply because they cannot get electricity, except on prohibitive terms, and the "business instinct" which perpetuates this sort of thing is not wholly confined to the companies' undertakings.

Still, judged on the basis of tariff, the municipal suppliers can claim, as a whole, to have done something tangible for even the smallest consumer, including the much disliked short-hour consumer, who, after all, must find a place in any scheme of electricity supply which is to be compatible with modern tendencies and requirements.

The companies, of course, have had their own troubles; insecurity of tenure has, no doubt, crippled their enterprise in recent years, and both this and early pioneering expenditure have been urged in extenuation of the comparatively high prices charged by them, although it must be admitted that these factors are unlikely to console the consumer.

However their financial position may have been prejudiced, it cannot be denied that the London companies have had a lengthy tenure of districts offering golden opportunities for business-getting on the whole, given the requisite enterprise and due recognition of modern requirements and facilities. Actually the average age of the London municipal undertakings is about 16 years as against roughly 23 years for the companies, and as it is only within the last eight years that turbine plant has been generally adopted for generating purposes, it is evident that the onus of replacing obsolete plant has not fallen upon the companies alone.

But if, on the whole, the figures which we quote are favourable to municipal supply in London, it must be remembered that municipal control frequently gives good cause for distrust.

Both good and bad examples of municipal management can be cited, and it can be urged against the best of them that the method of control by a municipal committee selected without regard to business qualifications, and, in any case, under the thumb of an even less informed Council, is likely to be unsatisfactory, particularly in view of the huge developments which may be expected in the future. Municipal engineers themselves admit its shortcomings, and the fact that Councillor Neumann, at a municipal conference in 1912, should have thought it necessary to read a paper indicating remedies for the present state of affairs, is most suggestive, as coming from within the municipal ranks.

However, the official report on the strike of municipal employés at Leeds last year contains even more convincing evidence from within as to the inefficiency which may creep into what one would consider a well-ordered service under municipal control.

It was, for example, found that the gas works were greatly overstaffed, and that certain old retorts which were in use required the labour of 60 men for the same output of gas as can be obtained by 12 men using modern retorts. The strike, at all events, served the good purpose of directing attention to the deficiencies of this department, and as the result of reorganisation, the staff could be reduced by 500 men, representing an annual saving to the city of £36,000! While we should hesitate to suggest that this is a common state of affairs, it may be taken for granted that whatever the deficiencies of unadulterated private control, purely municipal control is hardly likely to commend itself for a huge undertaking such as will be involved in the unified electricity supply of London. Here, then, is a matter for serious reflection on the part of the consumer—whose only requirements are a cheap supply of electricity and every facility for obtaining it—and of the public, whose interests are nowadays so closely bound up with electrical progress.

* The 10 lowest municipal flat rates range from 3d. to 4d. per unit, as against the seven lowest company flat rates of 4½d. to 5½d., and other initial rates are proportionately higher in the latter case.

Rubber. The general market for rubber has within recent weeks displayed little in the way of new feature, but taken all round the trade has been moving along quietly, and in not unsatisfactory fashion, with consumers taking good deliveries of material, while the movements in prices have been very small and the tone has generally been pretty steady. Plantation rubber still stands at a considerable discount compared with fine hard Para, and the arrivals of the latter as advised from Brazil are now and have lately been small. It is just possible that with small supplies of Para descriptions coming forward, the plantation product may be stimulated to some extent, as demands are turned upon it, but industrially the world's position is not any too cheerful or encouraging just now, and the outlook indicates a continuance of relatively quiet times. There has been rather less coming forward from the East of late, the shipments advised for May by the Federated Malay States authorities being 1,309 tons, compared with 1,548 tons in April, making the total for the five months of the year 7,026 tons, compared with 4,001 tons in 1913, and 1,772 in 1912. The auctions in Mincing Lane have been less too, the total handled at the two sales in June being only about 2,000 tons, a figure which falls considerably below that of some recent months, and the reduced quantities to hand have naturally assisted the market. There has recently been a rather more spirited inquiry in the

private market for far forward deliveries, even up to June of next year, business in which has been done at a considerable discount compared with the rates accepted for near deliveries. This implies but a slender faith in the future of the market, but on the face of it the price looks fairly cheap, and it may stimulate buying on this ground alone.

The cost of production is, however, certainly coming down in many directions, and this can only be of benefit to all concerned. Most estates have, of late, succeeded in materially reducing their working costs, and the process is capable of further and general application, so that on this score, apart from any question of over-production, there is room for a further shading of prices, and the lower they go the more is consumption likely to be stimulated.

In considering the question of costs of production, a correspondent of the *Times* has been working out results on what is termed a "normal" estate in Malaya, by which expression is meant an estate which has no exceptional or abnormal disadvantages, is provided with good transport, is near a port or railway station, is a self-contained economic unit as to size, and is carefully laid out as regards labour. Taking everything into consideration, the "all in" cost is given as 8·76d. a lb. on an output of 600,000 lb., and on the writer's calculations, such an estate, capitalised at £75,000, and with rubber selling at 1s. 2¾d. a lb., can pay a 20 per cent. dividend, while every additional 1d. a lb. on the selling price is equal to a further 3⅓ per cent. or so on the dividend.

In connection with the efforts made to extend the uses to which rubber is put, it may be mentioned that a lawn tennis court laid with rubber has been put down at the Agricultural Hall in connection with the Rubber Exhibition, to which court the public are admitted, and the innovation has proved a decided attraction, the ball playing off very truly. The court is, however, slower in play than asphalte.

The L.C.C. Tramway Deficit.

No tramway report at the present time is awaited with such critical interest as that relating to the year's working of the London County Council tramway system. Heavily capitalised as it is, with its resources seriously depleted by concessions which cannot be justified from a tramway point of view, handicapped in addition in its facilities for gathering traffic in London, and up against an ever-increasing 'bus competition, the result of the year's working—a deficit of £88,526—need not cause any surprise to those interested.

Much has been written on the burdens cast—many think unfairly—on the L.C.C. tramways, but for various reasons these remain substantially as before, and it has been left for the motor-'bus to demonstrate the weak places in L.C.C. tramway administration.

The Highways Committee's report will be read with interest by those who desire an explanation of the present position, and one short sentence explains a good deal. "The Council in framing its tramway policy has not looked at the matter solely from the point of view of the tramways undertaking." If it had, the present position would scarcely have arisen.

Criticism of the result, in view of the sentence which we quote, may be somewhat out of place; the only question is whether London is prepared to face a loss of £50,000 a year or more in the future for the privilege of possessing tramways which are admittedly not run on a self-supporting basis.

A considerable section of the report deals with motor-omnibus competition, pointing out the various directions in which the 'bus is more favourably situated than the tramway, and it cannot be denied that there is certainly something wrong in a system which levies rates on a tramway route, the paving of which is kept in order by the tramway, to be worn out by other traffic, but which levies no rates on an equal 'bus service along the same route, although the latter causes more wear for every mile run.

The "'bus track," equivalent to the tramway track, is the whole road, and for the continuous all-day-long use of the latter, it would appear to be only equitable that some rate should be levied on the 'bus as on the tram.

CONCERNING SWITCHGEAR.

By S. LEES.

With the advent of the new Home Office rules and regulations governing the use of electrical energy for industrial purposes, it seemed reasonable to look forward in the near future to some radical changes toward better designed switchgear. The lapse of time since the new conditions became operable has been, it must be admitted, ample for the production of some necessarily rather drastic, yet much needed improvements making for increased safety and facility of working in the operation of electrical apparatus.

Taking these facts into consideration, it seems surprising that to-day there is little, if indeed any, striking evidence of the results of the 1912 regulations. True, a considerable proportion of central-station switchboards are now grilled in at the back; strange to say, however, an accident recently occurred where an attendant was severely shocked and injured through falling off a travelling crane which was stationed temporarily above the rear passage of a main switchboard. Here, substantial locked doors had been fitted, but the top of the passage-way was, as is usual, open.

But it is not at the main controlling or distributing centres that improvement is called for so much as at the points of actual use; for it is here that we still find being installed types of switchgear (so-called) which whilst outwardly complying with the statutory regulations, are yet so badly constructed that failure may be expected at any time. Take a common example—the coupled pattern of multipole switch, iron-cased, of course. Almost invariably the insulating bar which couples the several contact members is made of some kind or other of fibre. Up to the size of 100 amperes capacity this bar may be anything from 3-16in. to ½in. (rarely the latter) square section. Now, quite a lot of drilling, etc., is necessary for the mounting thereon of the contact blades and other fittings, and it is by no means uncommon to find adjacent screws which pass at right angles touching on the way. The section of the insulating bar is thus seriously reduced, and it can hardly be a matter for surprise if the switch fails at an unexpected moment. Sometimes clips are used instead of screws for directly attaching contact blades, and a bar of thinner section is employed. What happens with this method of mounting is that, in order to ensure certain and reasonably good contact, the friction between blades and jaws is so great as to defy withdrawal by means of the handle or lever fixed to the insulating bar, the latter often being of such a pliable nature as to allow one blade to break contact whilst the other remains "hard on." This is typical of a small size of switch having 4 in. centres between blades, the fibre bar allowing a torsional twist of ¼-full turn. Wood, too, is largely employed for this purpose, a common method of mounting the usual U and V shape contact blades being by means of small nutted screws. Trouble with this class of switch is speedy and sure. A certain pattern of multipole switch still on the market is provided with a rather elaborate insulating partition disposed between the contact jaws, and the contact blades are coupled together by means of a wooden bar held in position by two metal screws, one to each blade, the ends of the said screws coming within a small fraction of an inch of touching each other *inside* the wood bar. A case of failure of a switch of this make was experienced by the writer, the operator receiving such serious injuries as necessitated his absence from work for nearly two months. Switch mountings inevitably work loose in operation and contact blades become detached, and short-circuit across jaws, or "earth" to case; the indiscriminate boxing-in of some types of switch-

gear often only accentuates trouble, as, with an open type of switch, a visible fault is more likely to be detected before any serious harm is done.

A particular form of double-pole service switch beloved of supply authorities is still with us, very little changed except, perhaps, that it must have its interior economy hidden under a cast-iron cloak of pretentious proportions. Its naked predecessor used to be a useful business-like sort of switch, always dependable. The present-day type is turned out by lots of "nameless" makers, and varies very little in the inside electrical details in the different makes, one point, at any rate, being its somewhat striking consistency. There is the familiar fibre coupling-bar which shows a decided reluctance to keep company with its contact blades, and there remains the same kind of handle grip which runs the whole gamut from "off" to "on" and reverse, without useful effect, and the cover has to be removed to elucidate the tactics of the erring switch. And what matters it if the live parts are only asbestos-paper thickness distant from the outer earthed case, there is still a full two inches length of break between contacts!

Truly, this robust mechanical method of enclosing small switchgear allows unlimited latitude for the unscrupulous hiding of a multitude of electrical sins inside, and especially does this apply to fuse-boxes or, as they were originally called, "cut-outs." More than one decade ago the act of an over-enterprising individual in trying to replace paired fuses simultaneously gave rise to the birth of the interlocking cut-out. Nowadays, it is not perhaps often necessary to stand at the top of a rickety step-ladder and nervously thread bare fuse wire and hold bare pliers in the one hand, the other member being in commission to preserve one's balance, but the risk of shock and burn is little if at all minimised, as the fuse holder is liable to be shattered, if the iron-clad, what-not-proof, switch happens to have an indefinite leak on a faulty pole. And, somehow, one cannot help feeling *afterwards* that short circuits, and once lightly considered "earths," possess grave potentialities for harm, especially when one sees such splendid shock-proof porcelain brought down just like so much candle grease.

Strangely discordant with electrical progress, the past year or so has witnessed the foisting on the market of a multitude of small switchgear bearing unmistakable evidence of inefficiency and yet presenting a prepossessing exterior. Commercial considerations would seem to be the principal operating cause of the demand for this admittedly cheap, but undesirable, line. Highly porous stone-ware insulation, pierced with screw-threaded holes, ungetatable and flimsy one-turn-thread terminals; fuse holders which require handling with one's handkerchief, and in which when inserted or withdrawn the porcelain bridge parts company with its contact clips —these are examples of this kind of accessory. One common pattern of fuse holder of which there are thousands in use, consists of a pot-ware tube having a frontal aperture and is described as a "safety" fuse holder. Again, a trough or channel-shaped piece of china ware, in which the fuse, *exposed*, reposes lengthwise is similarly labelled. Such devices are absolutely of no use, either utilitarian or aesthetic, and it would seem that the only reason for the existence of such freaks is an inexhaustible faith in cure-all porcelain.

The absurd idea of threading fuses through sinuous tunnelled paths, more or less contracted, while the terminals remain bare and exposed, is still worked. At this day one might not unreasonably expect a better knowledge of these details. A short time back the writer had occasion to handle in service a new type of safety fuse-holder. This was of the indicating variety, and consisted of a length of fibre tube fitted with removable brass-capped terminals, binding posts being at the extreme ends. Inside the tube there was a perforated china bobbin through which the fuse wire passed, the normal position of the suspended bobbin with fuse intact being opposite a small sight hole located centrally at the front of the tube. When the fuse ruptured the bobbin was supposed to fall by virtue of its own weight to the bottom of the tube, thus uncovering the sight hole and indicating a blown fuse. Unfortunately, oftener than not, it happened that the fuse would part either above or below the bobbin, owing, probably, to the inevitable weakening of the fuse wire at the point of attachment to the binding screws, and so although holding a blown fuse the bobbin remained in position indicating "good." Excepting that it was well made this example was nothing but a freak; the bare terminal caps were flush with the fibre tube, and very careful handling was necessary to avoid making contact at top or bottom with the metal fuse box. The operation of re-fusing was quite a business as the terminal caps had to be taken off the holder, the indicating bobbin withdrawn, and the holes cleared of blown metal, before inserting fresh fuse wire.

A useful and proper accessory, the common portable type of hand lamp, has of late been the cause of quite a number of disquieting accidents. This fitting is made up in almost countless forms, all professing to conform to the new regulations. Some are weird in shape, of wire labyrinth defying any photometric conclusion thereon; others remind one of the appanage of the old town crier. The construction appears to be first and foremost to render abstraction of the lamp proper the despair of thieves, but this advantage is considerably off-set by the necessity of having to dissect practically the whole thing in order to replace a faulty lamp. The vital part in all remains the same—the conventional B.S. lamp-holder with its attendant weaknesses and disadvantages. One might say a good deal critically, too, about the means of communication between lamp and plug connection. The latter is oftener than not a most reprehensible kind of fitting; and one views with some alarm the increasing vogue of the common wood-cased B.S. lamp-top form of adapter for use on portable circuits. The application of this type of accessory to highly inductive circuits, heavy heating devices, and the like, cannot be too strongly condemned. Quite recently the writer came across a modern power supply station, newly wired, the portable circuits of which were fitted up with ordinary batten lamp-holders. In absurd irony a number of hand lamps were in use for boiler cleaning, the flexible runs thereto being of steel-armoured cable (almost heavy enough for house services), and a few inches from the lamp-holder and the adapter plug the armouring had been cut away to allow of entry of the conductors, thus exposing the very thin coating of rubber insulation. Near at hand a one-horse-power portable air compressor was at work, plugged to an ordinary lamp-holder, the leads in this case being twin lamp flexible wire of a very poor quality, and as bearing evidence to its misbehaviour, every foot run or so wore a self-accusing bandage of tape. The adapter plug in this case was not itself visible, owing to a very complete encasement of insulating tape, which had been applied as a precautionary measure against the ill-effects of short circuits, of which experience was obviously not wanting.

Of recent years the tendency has been for an ever-increasing use of the bar blade or knife form of switch, and at the present time we find that this type, or some modification thereof, is generally accepted as a sort of standard for hand non-automatic gear. Otherwise possessing the qualities that go towards a simple and efficient design of switch, it is the exception to find an example fitted with a really safe hand shield or guard, notwithstanding that, in the Home Office rules and regulations it is provided that:—

Clause 3.—Every switch, switch-fuse, circuit breaker and isolating link, shall be: (a) so constructed, placed, or protected, as to prevent danger; (b) so constructed, and adjusted, as accurately to make and maintain good contact; (c) *provided with an efficient handle, or other means of working, insulated from the system, and so arranged that the hand cannot inadvertently touch live metal;* (d) so constructed or arranged that it cannot accidentally fall or move into contact when left out of contact.

The closing of such a type of switch, with unprotected handle, on, say, a faulty heavy power circuit, would in all probability have (in fact, has had) disastrous results on the hand, at least, of the unfortunate operator. The provision of an efficient shield or guard, not merely to prevent contact with adjacent "live" metal, but effectually to protect the operator's person from injury at times of abnormal occurrences should be made compulsory. And with what ludicrous inconsistency one finds, too often, really splendid examples of first-class plant controlled by safety (save the mark!) switch gear, fool-proof, etc., etc., which wrecks itself when a fuse ruptures. The writer has had experience of more than one instance of plant ruined through failure of insufficient switch gear at a critical moment.

For one reason, owing to its superior mechanical qualities, at least as regards its ease of handling in manufacturing processes, the employment of fibre in its many guises appeals to makers of electrical apparatus, particularly switchgear. But fibre is very uncertain in its behaviour, and under work-a-day conditions warping or twisting sooner or later sets in, causing distortion of switch mountings. The necessary care is not always paid to proper selection of samples in assembly, due regard to "grain" or "run" being commonly neglected. Experience has proved, time and again, the unsuitability of this substance for electrical work; therefore, the discontinuance of the use of fibre for insulating electrical apparatus cannot be too sternly insisted upon.

The writer is far from condemning wholesale the employment of vulcanised fibre, as it has undeniably, many useful applications in electrical practice for which it is peculiarly suitable, being both cheap and easily fashioned. For insulating metal hand rails, and similar protective fencing for electric power supply stations, fibre tubing forms a safe and convenient covering; and for shields or guards for hand-operated switchgear, sheet or moulded fibre may be introduced where the presence of wood or other easily fired material would be quite inadmissible.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electricity Supply in London.

The following comparative figures will be cold comfort to those who find so much to abuse in everything connected with the supply of electricity in London.

In the London County Council analysis of accounts of companies and local authorities for the year ending December 31st, 1911 (or March 31st, 1912) the average prices are given as :—

Private lighting	3·43d.	per unit.
Street lighting	1·50d.	,,
Power and heat...	1·17d.	,,
Bulk supply	·97d.	,,
Traction supply	·73d.	,,

By applying these figures to units sold for different purposes in Continental towns for the same period, we obtain the average price which would have been received had London rates been charged. A comparison with the rates actually charged shows that in every case except one the consumers would have been grateful if they could have obtained their supply at London rates.

Town.	Average price at London rates, 1911-12.	Average price received, 1911-12.	Above or below London rates, 1911-12.
Amsterdam ...	1·614d.	1·412d.	− 12·5 %
Buda-Pesth ...	3·129d.	4·632d.	+ 48·0 %
Breslau ...	1·645d.	2·443d.	+ 48·5 %
Copenhagen ...	1·849d.	2·865d.	+ 54·9 %
Dresden ...	1·158d.	1·968d.	+ 70·0 %
Hamburg ...	1·274d.	2·951d.	+131·6 %
Leipsic ...	2·543d.	3·120d.	+ 22·7 %
Munich ...	1·429d.	2·137d.	+ 49·5 %
Vienna ...	1·575d.	2·544d.	+ 61·5 %

The usual fashion is to compare the average price received in the last completed year in some American city doing a big business in bulk or traction supply with the average price in London two or three years back. It all helps the argument that London suffers from high prices, but it is scarcely cricket. If anyone will add to the list given above, I hope they will see that the London rates they use are for the same year as that for which they have the figures for the other town, and also see that they have the units properly divided into their respective classes. "Lighting" often includes street lighting, "Power" frequently includes high-tension bulk supply and sometimes traction.

I am quite satisfied that London has nothing to fear from any such comparison with foreign towns, and the larger this list can be made, the better.

L. H. Hordern, *Manager,*
Westminster Electric Supply Corporation, Ltd.

London, S.W., *June 26th*, 1914.

Lightning and Trees.

Your article in the Review on June 26th contains much interesting information, but I cannot quite agree as to the immunity of the beech tree, or that it would be safe to shelter under this or any tree. I think that the comparative resistance of the wood has little if anything to do with its selection by a flash; if rain is falling, one or more streams of water run down the sides of the tree, forming a conductor, which is insufficient at the time of the discharge to carry off all the electricity, and, therefore, it becomes so suddenly converted into steam as to blow out the bark along the line; in this case the lightning passes outside and also along the boughs; but it may also enter the tree at the junction of some main branch with the stem, and partly descend by the sap, and in this case the trunk is splintered; generally these trees, which are found shattered, have been struck before the rain fell.

That discharge takes place from twigs and leaves is, I think, shown by sheep being killed which have been lying some distance from the trunk; after a storm in Stirlingshire I found that, out of a number killed, one sheep was lying almost outside the shelter area of the branches of a large tree. It, therefore, appears to be dangerous to shelter under the boughs of any tree.

The extraordinary evidence of the Wandsworth Common keeper, "that it was not dangerous to stand under trees if there was plenty of earth near the base of the trunk," shows the ignorance of the public, who ought to know better; but the little children who were killed had no means of learning about the risk, and I think that warning notices should be exhibited in all country and parish schools during the summer months and their significance explained by the teachers. The Electrical Review has done good service by publishing "Suggestions for dealing with electric shock," and if you would draw up simple rules showing "How not to get struck by lightning," you would give schoolmasters and employers of labour an opportunity of making the danger more generally known. I will conclude by offering the suggestions published in my book, "Modern Lightning Conductors" (London: Crosby Lockwood & Son, 1910), under the heading, "Where to Seek Safety in a Storm," as a nucleus for rules, and also any additional help that I could give.

Killingworth Hedges, M.I.E.E.,
Hon. Sec., L.R.C. (1905 *Report*).

London, *June 29th.*

Hanover Square School of Electrical Engineering.

It has recently come to the knowledge of the undersigned that there is a desire on the part of several electrical engineers who received their technical training at the Hanover Square School of Electrical Engineering, to have an annual *réunion* where old ties could be renewed.

Such annual *réunion*, to accord with the natural inclination of most Englishmen, would probably take the form of an annual dinner which might be held in different parts of the country in successive years.

In order to place the matter on a proper footing, it will be necessary to form a Committee, and we suggest that any gentlemen willing to serve on such a Committee should send their names to one of the undersigned.

Frank J. Moffett, B.A., M.I.E.E.,
Union Chambers,
Temple Row, Birmingham.
Lancelot W. Wild, M.I.E.E.,
York Mansion,
York Street, London, S.W.

June 29th, 1914.

Timber Drying.

According to the extract from the *Melbourne Age*, page 1041 of your issue of June 19th, Australian blackwood boards 1 ft. wide, take four to five years to dry in the open, with a loss of 25 per cent. through warping. After a preliminary application of an electric current for eight hours, the air drying is reduced to four or five months, and the loss through warping, &c., reduced to 10 per cent.

The losses from warping could, however, be entirely eliminated without any preliminary treatment or any re-handling, by drying the boards in a moist air timber dryer. The circulation of moist air prevents warping, case-hardening or other injury, while drying the wood in about a fortnight, at very small expense.

The modified Nodon process of applying a slight current of electricity to wet wood, described on page 1049 of the same issue, is evidently very similar. The wood is first piled between jute blankets saturated with water, and subjected for one or two days to an electrical current; then taken out and stacked for drying in a position exposed to strong winds.

A strong electric current would admittedly crack or split the wood; so the current is limited to 150 ampere-hours at, say, 60 volts per cubic metre, or, say, a quarter of a unit of electricity per cubic foot of wood. The heat in this electric current is so small as to have no appreciable drying effect, so it appears very misleading to claim that "the time necessary for *drying* wood by the Nodon process varies from one to two full days." This actually is the time that the surfaces of the wood are soaked by contact with wet blankets, preliminary to restacking for air drying.

The results claimed for the Nodon process plus the subsequent drying appear to be precisely those achieved by drying alone, viz., the oxidation of the resiniferous materials in the sap, a molecular transformation of the cellulose, and a supression of destructive germs.

Electricity could be used as a drying agent in a moist air dryer; but it is much more usual to heat the air by steam, thus utilising all the latent heat. When steam is used to generate electric current, all the latent heat is necessarily lost, and, therefore, the drying of timber by electricity would involve prohibitive cost. It would not, however, involve the additional handling of the wood that is incurred in the Nodon process of passing an electrical current to wood placed between wet blankets, prior to restacking for drying.

Erith's Engineering Co., Ltd.

London, *June 25th*, 1914.

Geissler Tubes.

I should be very much obliged if either you or any of your readers could give me some information regarding the life of the different gases and electrodes which are inside the ordinary Geissler tubes, *i.e.*, how many hours such a tube may be worked before the gas or electrode is destroyed; and, further, what exactly becomes of the gas?

I understand that in the Moore tube, nitrogen or CO_2 gas has to be continually fed in—here, again, I should be glad if anyone could tell me what becomes of it, and what would happen if the gas supply were stopped?

Medico.

The Training of the Instrument Maker.

With reference to the letter which appeared in your "Correspondence" columns of June 26th, in regard to the training of the instrument maker, I would like to suggest a few points which I am sure would benefit both employers and employés as regards becoming good workmen and producing good workmanship.

For instance, if there were the opportunity of overcoming all the difficulties mentioned in Mr. Paul's letter, which would come the best off, after taking all expenses involved on the apprentice's side, and the wage he has to have for all his theory and practical training as a skilled instrument maker?

I suggest that favouritism should be abandoned, which is a great hindrance in most shops, and that energetic apprentices should be advanced to a higher rank according to their abilities, which not only would encourage the apprentices, but satisfy their employers.

Again, as there is so much competition in instruments and the making of them, I think it would be very difficult for one to attend a trade school and learn every method different firms have in the manufacture of instruments, &c. If they learnt, for example, A's method, B's, perhaps, would be much the same instrument, but a totally different method of manufacturing, so it is a case of "No man can serve two masters." I should like others interested in the above letter to bring this matter forward, looking on the employés' side, in addition to the employers', therefore to benefit the latter.

N. Ingleby.

June 29th, 1914.

LEGAL.

SENGHENYDD PROSECUTIONS.

According to the *Birmingham Daily Post* the summonses brought by the Home Office against the owners of the Lewis Merthyr Consolidated Collieries, and Mr. Edward Shaw, manager of the Universal Colliery, Senghenydd, for alleged breach of the Mines Regulations, were heard at Caerphilly on June 17th. There are 21 summonses in all. Of these, four are against the company and 17 against the manager, all being taken at the instance of Dr. Atkinson, Chief Divisional Inspector of Mines, and as the result of the Home Office inquiry into the cause of the disaster at the Universal Colliery in October last, when over 400 lives were lost.

Mr. Ivor Bowen, K.C., in opening the case for the Public Prosecutor, said the explosion caused the loss of 439 lives. In May, 1901, there was a previous explosion, which caused the death of 81 lives. Two exhaustive inquiries had been held into the cause of the present disaster, but no definite conclusion could be arrived at. The Court would be concerned with an investigation of a very different character. They would have to consider whether during the month preceding the explosion the mine was managed in conformity with the statutory law. The first summons was against Edward Shaw for neglecting to appoint in writing a person to examine the safety lamps. The defence was that the lampman was appointed 17 years ago, and was a competent person. He received a note stating the nature of the duties, but this had been lost.

The Bench decided to hear all the cases before giving their decision, and the hearing of the other summonses was deferred until July 14th.

WORKMEN'S COMPENSATION.

On Friday, in the Marylebone County Court, Ethel May Faber, 18 years, of 3, Golborne Gardens, North Kensington, was awarded £9 damages and costs for personal injuries, the defendants being the International Electric Co., telephone manufacturers, of 85, Gracechurch Street, E.C. It appeared that the plaintiff was employed at the company's works at Salusbury Road, Kilburn, being engaged at 7s. a week on a power press machine, which continued to work when the treadle was not being touched by the operator. On April 14th last, while the plaintiff was attending the machine, her left thumb was severely crushed by the descending press. It was alleged that the accident was due to the absence of a guard, and that this constituted legal negligence.

KENNA *v.* DUBLIN UNITED TRAMWAYS CO., LTD.

AT Dublin last week, before Mr. Justice Kenny and a special jury, John Kenna, a provision merchant, claimed £2,500 from defendants, for personal injuries alleged to have been caused by the negligence of the defendants and their servants in the control and management of a tramcar on February 1st. Plaintiff was on top of a car which went off the rails and crashed down upon the pavement. He was pitched into a heap of broken glass. Evidence as to injuries having been given, a police witness said that the driver attributed the accident to the failure of the points to set automatically.

According to a report in the *Dublin Daily Express*, Serjeant Sullivan said the accident was due to an occurrence which could not have been foreseen. In many places the tramway points were manipulated by an electric contrivance. The system had been well tried in many places, and until this night in Merrion Square it had never been known to fail. When the electrical point system failed for the first time in its history the driver committed an error of judgment, when he found himself on the wrong line, by slapping on his brakes, and it was this that caused the car to overturn.

MR. GEORGE W. HARRIS, electrical engineer to the Tramways Co., stated that the points where the accident occurred were designed to make a straight run to Dalkey. The driver of the Donnybrook tramcars had a means of setting the points to enable him to take the turn, but they resumed their position automatically. He examined the points an hour after the accident, and found them in good order, and no repairs had been found necessary since. An evilly-disposed person could move the points in the wrong direction. He thought the accident was caused by the sudden application of the track brake. It was a company rule that such points should not be approached at a greater speed than two miles an hour.

Evidence was given to show that the car was proceeding at a moderate rate of speed.

The jury found for the plaintiff, and assessed damages at £550. A stay of execution for 14 days was granted.

MARCONI AND MARCONI'S WIRELESS TELEGRAPH CO., LTD, *v.* HELSBY WIRELESS TELEGRAPH CO., LTD.

AS mentioned in our last issue, Mr. Justice Eve and an Assessor commenced the hearing in the Chancery Division on June 24th of this action, claiming damages in respect of alleged infringement of letters patent. The infringement was denied.

MR. WALTER, K.C. (for the plaintiffs), said the patent was No. 7,777 of 1900. It formed the subject of an action heard some time before by Lord Parker, then Mr. Justice Parker, and it had now expired by effluxion of time. The defendants had manufactured and supplied wireless installations to four ships belonging to the London and North-Western Railway Co., and that was the matter complained of in that action. The defendants attacked the validity of the patent, and as far as the Marconi experts could see, they attacked it upon the same grounds as before, while as regarded infringement, the plaintiffs' expert witnesses could not see any distinction between what had been done by the defendants and what was done in the case before Lord Parker. The defendants, besides denying the infringement, alleged that the invention was not new; that it had been published in this country before the date of the letters patent; that it was not useful; and that the specifications did not sufficiently describe and ascertain the nature of the alleged invention, or in what manner it was to be performed.

Under the last head the defendants alleged:—

(*a*) No sufficient directions were given to determine the self-induction or the capacity of the aerial for the purpose of calculating the product of the self-induction multiplied by the capacity of the circuit containing the aerial in the transmitter and receiver.

(*b*) No sufficient directions were given whereby with the data appearing in the examples, the product of the self-induction multiplied by the capacity could be the same in each circuit.

(*c*) The specification failed to state or indicate whether the time period of the two circuits of the transmitter was to be made the same when the two circuits were considered separately or when coupled together as in use. Further, no sufficient directions were given whereby it could be ascertained whether equality in the time periods of the two circuits when the transmitter was in use had been attained.

(*d*) No sufficient directions were given as to the degree of couplings desirable between the two circuits of either the transmitter or the receiver.

(*e*) If it was contended that in order to get selective signalling the two circuits of the transformer in the transmitter were to be both lightly coupled, and to be tuned so that the time period of the oscillations in the two circuits was the same, no sufficient directions were given how it was to be carried into effect.

(*f*) No sufficient directions were given as to the length and disposal of the leads constituting the closed oscillation circuits or whereby their capacity and inductance might be calculated.

(*g*) No sufficient directions were given as to how the circuits were to be arranged or adjusted if the oscillations were to be harmonics of each other.

(*h*) If upon the true construction of the specification the use of an "auto-transformer" was comprehended in the first or any claim no sufficient or any directions were given how to carry the invention into effect when using such a device.

Counsel proceeded to deal in detail with the development of wireless telegraphy up to the present time. The judgment of Mr. Justice Parker given at the previous action referred to was also read.

Prof. Bertram Hopkinson sat as assessor and counsel. Engaged in the case were Mr. Walter, K.C., and Mr. Hunter Gray, for the plaintiffs; Mr. Courtney Terrell and Mr. Arthur Jaffe for the defendants.

Evidence was then called.

MR. JAMES SWINBURNE, examined by MR. HUNTER GRAY, for the plaintiffs, said he had read the judgment of Mr. Justice Parker in the previous case, and agreed that it was a complete and full statement of the art of wireless telegraphy.

COUNSEL: Would you, in a few words, tell my Lord what you conceive, from the electrical point of view, to be the step which Marconi took, over what was done before, by his 1900 patent?—The step was having one circuit with a condenser, which he could charge up with a great deal of energy, and which could oscillate without being stopped much, as far as the circuit itself went, passing the energy of that gradually over into another circuit, which was a specially good radiator, and get the energy over in small portions to keep that radiator circuit going till the energy was all dissipated.

The words of the specification on page 3, at line 11, are:—"This device enables more energy to be imparted to the radiator than heretofore, the approximately closed circuit of the primary being a good conserver, and the open circuit of the secondary a good radiator of wave energy"?—Yes.

Do you know what the effect of the improvement of the Marconi 1900 device was over the 1896 one?—It increased the distance enormously. You may almost say the modern development of wireless telegraphy is due to it. I do not mean to say that every modern system infringes it, but it gave a start to wireless telegraphy.

I think you have visited one of the ships, the *Cambria*. Would you explain what is the operation there?

Witness did so, and Counsel continued: Does this system work in accordance with Marconi's 1900 specification?—Yes.

Counsel: You saw this in operation?—Yes.

Did it operate so as to have a closed circuit which conserved the energy and gave it out in small quantities to an open circuit which radiated the energy?—Yes.

Was it a device which enabled "more energy to be imparted to the radiator than heretofore, the approximately closed circuit of the primary being a good conserver, and the open circuit of the secondary a good radiator of wave energy"?—Yes, I think so, certainly; but it must be remembered that this was an established installation, and the capacity of the aerial was larger than it would have been in the time contemplated by the 7,777.

His LORDSHIP: Is there any transformer?

MR. HUNTER GRAY: There is an auto-transformer. (To witness): When you saw that apparatus was it tuning?—Yes.

Do you find the invention the subject of the patents described in any of the documents specified in the pleadings?—No.

It is suggested that the invention is not useful?—It certainly is useful, I think.

It is pleaded that the specification does not sufficiently describe and ascertain the nature of the invention, or in what manner it is to be performed. What do you say with regard to that?—I think it describes all that is necessary for an engineer to carry it out.

MR. TERRELL then cross-examined: In the case of Marconi's specification, you say that you get your radiator continually radiating a train of waves. And you get your oscillator continually going on oscillating all the time and making up for the losses as they are lost by the radiator?—Yes.

Then you get a series of waves slowly diminishing for your primary, and underneath you will have another series of waves that will be not quite in the same phase with these which would be going on all the time from your radiator?—Yes, that is the idea of Marconi.

That is the essential feature of Marconi's invention?—Yes.

Counsel put to Witness a wave train that had been worked out.

WITNESS said: The whole point is that the theoretical wave would have to put just as much energy each vibration into the secondary as the secondary sends out. If there is a difference of a quarter of a period in lag right through as the amplitude gets less, I think the proportion of radiation would alter, and you would tend to get out of step. I do not know if it makes any difference.

Supposing the conditions do not exactly fulfil that state of affairs, supposing the energy transferred from the primary to the secondary is rather too much for the secondary to radiate, and the secondary puts some of it back into the primary, and that sort of exchange goes on. There are different periods of oscillation going on in the primary?—I follow it.

You will not get from the aerial all one wave length right throughout?—No.

But whatever may occur in Marconi's actual example, you are satisfied that is the kind of thing he tells the engineer he wants?—That is what he wanted to get at; but, as a matter of fact, that needs generally a weaker coupling than is actually in practice used by Marconi. The practice is to have the circuits more coupled than that, and you do get a double wave.

I am not saying that if, as a matter of fact, you get a double hump wave in Marconi, that, therefore, Marconi's ideas are all wrong.—No; they are substantially right, only I do not know whether he knew of that fact; very likely he did not. It is a disturbing influence in the Marconi system.

You say that Marconi means loose coupling.—Witness: The question of the looseness of the coupling will depend on the nature of the aerial, whether the aerial is one that radiates much in proportion to its oscillation.

Referring to the presence of two wave-lengths in the secondary circuit in a given case, Counsel said: The coupling is 10·6 per cent

In that case you get two humps?—I think you always find the two humps.

I understand the distance between the two humps is a measure of the coupling?—Yes, the less the coupling the nearer they come together.

So that, in all these Marconi examples, in carrying out the invention according to Marconi, you do not get the natural wave of the aerial emitted?—No.

You do get a state of affairs such that when you are sending out messages on one wave length, anybody who is tuned to the other peak of the curve will also receive the message?—Yes.

And you do not get your energy concentrated on to the wave length which you are sending out?—No, you do not get it at all in one wave length.

Will you take Lodge's specification No. 11,575* of 1897? Did you regard that as of great importance?—Yes.

The first thing that Lodge did was instead of taking the old aerial that Marconi and other people had been using, a tall aerial with a spark gap in it, he put inductance into it?—Yes.

Instead of having a heavy wave, he says the effect is that you will not get it rapidly damping down, but it will steadily swing till it comes to rest, and the length of wave will be approximately an equal amount?—That is the fact.

The point of Lodge was to get his material oscillating, leave it alone, and let it slow down till it died out, when he would make it oscillate again?—Yes.

Lodge wants to cut off the source of electricity as soon as you can?—He does, but he does not want, to use a modern expression, to quench an oscillatory spark. Lodge says he is going to use the impulsive rush. That goes back to Lodge's ideas on the question of lightning, and he explained in his paper on lightning that you could get a discharge by what he calls the impulsive rush. He was not considering the impulsive rush as an oscillatory discharge at all, simply as a sudden discharge.

Will you compare Lodge, fig. 4, with fig. 6, which is alleged to be the infringement. Surely, is it not that in fig. 6 you have got an apparatus for tuning, and in the fig. 4 you have not got it shown?—No, not only an apparatus for tuning in fig. 6, but the whole idea is absent from fig. 4; and you have got an aerial inductance in fig. 6, which will make the difficulty still greater.

Do you know what would be the effect of shorting the gaps in the infringement, and also the gaps in fig. 4—the charging gaps; that means putting a wire across them? Would it make it more, or less, like Marconi's?—It seems to me it is pretty much the same as Marconi's whichever way you take it.

I am going to show you the wave train that was produced by calculating the decrement. We took the decrement from the resonance curve, and plotted the wave train following the decrement, and this was the result obtained?—It looks all right to me.

In the last case you said the energy passing between the primary circuit and the radiator of Marconi was like that of a miser supporting a spendthrift son? Also, in that case, when talking of the Marconi circuit, the primary circuit, you said: "When it does discharge it will oscillate for a long time without much waste of energy. He uses that oscillating circuit to excite the antenna. He arranges his antenna to be of the same frequency so that it can be excited in the best way possible by this primary circuit, and by that means, though his antenna circuit is a circuit which cannot hold much energy to begin with, he keeps supplying it with energy as it gets used up?"—That is right.

Mr. James Swinburne was recalled and re-examined by Mr. Walter with regard to the inspection of the *Cambria*.

Counsel: I think in your presence the wave length was actually determined, was it not?—The measurement was taken with the wave meter.

It was 500 metres?—Yes.

You were also told at the time by Mr. Chambers that the coupling was 5 per cent.?—Yes.

And you were also told, you examined it yourself also, that the primary and secondary were tuned?—Yes.

Mr. Courtney Terrell: We admit the coupling was somewhere in the order of 5 per cent.

Mr. Walter: Does quenching mean damping?—No, not properly. If you have a circuit which has resistance in it, it will damp, the resistance will use up energy very quickly, and the oscillations will die down very quickly. What you want to do in quenching is another thing altogether. You want to quench the instant when all the energy has been put out of the primary into the secondary, and disconnect the primary completely at that instant; that instant is when the secondary has got practically the maximum energy into it, and the primary has nothing.

How many complete swings will there be with a 5 per cent. coupling?—You want, roughly, about 20 complete swings before the whole of the energy of 5 per cent. is taken into the secondary.

Mr. John St. Vincent Pletts then gave evidence.

Mr. Hunter Gray (examining): For many years you have devoted yourself to electricity, and its application to wireless telegraphy?—Yes, 15 years with the plaintiff company.

I think you were responsible for the installation of some of the earliest of the practical Marconi stations?—Yes. I was engaged on the erection of the first chain of wireless commercial stations in the world in 1900.

Have you worked out the tunes in the specification in suit in this action?—Yes.

First of all, with regard to the couplings, because that seems to be the important matter, what were the couplings which were less than 3 per cent.?—The couplings derived from tunes Nos. 2 and 4 were both very small—something less than 3 per cent. It is very difficult to determine these couplings with any degree of accuracy, when they are very small, on account of the two humps coming close together, and merging into one another.

Mr. Hunter Gray: You went down with Mr. Swinburne and Mr. Dugald Clerk and made the measurements which you are speaking of now, at the defendants' station?—Yes.

I think you have also reproduced the circuits which you tested at Chelmsford at the plaintiffs' works?—Yes, I reproduced them from the data I took on the ships.

Perhaps you had better tell my Lord, in your own words, what you did?—We inspected the apparatus and noted the general arrangement of the circuits, the way that the common and the external inductance was arranged, and then we took the resonance curve from the aerial, actually from the earth wire and the aerial, so that we found the wave length which the station was emitting. We varied the common inductance in order to see that the two circuits were in tune, and we found that they were quite well tuned, because if they were thrown a little bit out of tune, the lamp which was placed in the aerial circuit did not glow brightly, showing that there was a very small current in the aerial, instead of a comparatively large current, which was obtained when they were properly tuned.

Will you tell my Lord what this resonance curve indicates to you as regards the nature of the installation?—This resonance curve is only consistent with two loosely-coupled circuits or with two tightly-coupled circuits and a quenched spark.

Is it consistent with two loosely-coupled circuits and a quenched spark?—No, certainly not.

It has been said that damping is an alternative position. Is it consistent with two loosely-coupled circuits and excessive damping?—With excessive damping the curve in itself might, perhaps, be, but the amount of energy which could be radiated from the aerial would be purely negligible if the damping were so large that there was no interaction between the two circuits.

Was there any special damping means employed?—No, certainly there was not. It was an ordinary circuit with ordinarily good conductors in it, and three or four spark gaps.

Mr. Hunter Gray: Would these three or four spark gaps, without special means, give such damping as would be consistent with this curve?—With or without any means that I know, they would not give any such damping.

You have reproduced the installation at Chelmsford and tested it?—Yes. To my mind the curve we obtained at Holyhead, as I think I have said before, is only consistent with tight coupling and quenching, or with very loose coupling, and no quenching.

(To be continued.)

PARLIAMENTARY.

North Metropolitan Electric Power Bill.

On June 25th a Select Committee of the House of Commons, under the chairmanship of Mr. Hugh Law, considered this Bill. Among other things, the Bill gives the company power to use land at St. Albans for the erection of a generating station, and to take electric current in bulk from the Metropolitan Railway Co. and the London and North-Western Railway Co. Further, the Bill gives the company power to promote electric lighting provisional orders and to raise £250,000 additional capital.

Mr. Fitzgerald, K.C., who appeared for the L.C.C. in opposition to the Bill, urged that the project was of a novel character which would establish a precedent which might have very far reaching effects. The L.C.C., he pointed out, was empowered to take over the whole of the electric supply of London in 1931, and if the Bill was passed the present situation, which was already greatly complicated, would become more so.

Opposition was also made by Mr. Freeman, K.C., representing the existing electricity undertakings in London.

After some evidence had been given, the Chairman stated that the Committee had decided to approve the preamble of the Bill, subject to the proviso that the Bill should be modified so as to limit the powers conferred upon the promoters to the area in which they were at present supplying electrical energy, excluding any portion of the administrative area of the L.C.C. not at present supplied.

Swedish Water Power.—It is stated that the High Court at Stockholm has now given a decision in the action which has been proceeding for several years between the State and the Krongede Water Power Co., in regard to ownership rights of the Krongede falls. The decision is in favour of the company, and will enable the Svenska Emissions Aktie-Bolaget, which has a share capital of £659,000, to utilise the falls, which represent a total of 90,000 H.P. The emission company holds the majority of the shares in the water power company. It is impossible to foresee whether the power available will be used for railway purposes, but adequate possibilities of disposing of the production already exist in the saw mills and mines which are located in the vicinity of the falls.

BUSINESS NOTES.

Trade Announcements.—MR. HERBERT J. HAWKINS, M.I.E.E., has taken offices at 42, Cheapside, London, E.C. Manufacturers are invited to send him catalogues and other literature applicable to central station requirements.

The telephone number of the ELECTRICAL CONTRACTS AND MAINTENANCE CO., LTD., Sanctuary House, Westminster, is now "Victoria 6757."

MR. G. BRAULIK, of 8, Lambeth Hill, London, E.C., asks us to announce to the trade that his business has now been reconstructed and put on a sound footing, and that the rumour that the business has been discontinued is absolutely unfounded; in fact, the business is now being conducted on up-to-date lines, and a large and well-assorted stock of all saleable goods is being kept.

Co-operative Purchasing in Germany.— The Einkaufs Vereinigung for electrotechnical articles of Frankfort-on-Main, which has a working capital of £17,300, reached a surplus of £22,000 in 1913-14, as compared with £11,900 in the preceding year. The creditors represented £53,000, whilst the debts owing at the end of the year amounted to £84,000. During the year the number of members increased by 69 to 197.

Trade in Colombia.—In the course of a report on possible openings for trade in Colombia, the Canadian Trade Commissioner for the Latin-American Republics, says:—One thing that, perhaps, militates against the extensive use of calcium carbide is the fact that Latin-Americans favour electric light, and consequently where cheap power can be furnished, lighting plants are being established, even in some of the smaller towns. Both American and Scandinavian carbide are being imported into Colombia, the latter being purchased through London. The price is about £15 per ton c.i.f. Puerto Colombia. Electrical material is imported from the United Kingdom and the United States. This trade is likely to be an increasing one, owing to the expansion of the mining industry and to the increase in electric lighting plants. The statistics show that the increase in imports of this material in 1912 over the previous year was about £15,000.

Electric Clocks.—MESSRS. GENT & CO., LTD., Leicester, report considerable activity in their electric clock department. Their "Pulsynetic" system installed on the *Aquitania* behaved very satisfactorily on the maiden voyage of the great liner. Similar installations are in progress for two C.P.R. boats now building, and also for a new liner for Patrick Henderson & Co. The Allan Line offices at Montreal are also being equipped. Among many other installations in hand are the following:—

Delhi Station, East Indian Railway.
Dominion Bank, Toronto (50 dials, mostly in marble cases).
Henry Birks & Son, Vancouver, B.C.
Large striking and chiming turret clock for new Grey Institute, Port Elizabeth, S.A.
Turret clock and 50 dials for Australia.
Astronomical clock for Odessa Observatory.
St. Mary's Church, Northampton, four-dial turret clock.
Ardol, Ltd., Selby.
De Montfort Public Hall, Leicester, four-dial hanging clock
Children's Hospital, Leicester.
Watson Laidlaw, Glasgow, 20 dials and time bells.
Glasgow Corporation Tramways.
Aberdeen Station, N.B. & Caledonian Railways.
St. George's School, Glasgow, turret clock with chiming gear, &c.
Edinburgh Evening News, 17 dials.
Academical Club, Glasgow.
Newton Abbot Secondary Schools.
Oxford County Asylum.

Annual Outings and Sports.—MESSRS. SIEMENS'S Tantalum and Wotan Lamp Manufacturing Department (Dalston) held their annual outing on Saturday last, when over 400 employés travelled by special train to Hastings. The company left London Bridge about 7 a.m., and was favoured with glorious weather. As in previous years, the firm bore the cost of travelling, thus leaving the individual members of the party free to make their own arrangements as to catering and entertainment. Mr. A. M. Hicks, who acted as secretary, organised the event to the complete satisfaction of all concerned. Mr. Le Marechal, the genial works manager, accompanied the party, and in conjunction with the secretary, spared no effort to ensure for those present a most enjoyable day's outing.

We are pleased to learn that the annual athletic sports held in connection with the firm of MESSRS. CROMPTON & CO., LTD., on Saturday, June 20th, were an unqualified success. The excellent ground possessed by the club at Wood Street was in perfect condition, and it is looked upon as one of the best sports field belonging to any works in the Eastern Counties. In previous years the races had been confined to employés at the Arc Works, but this year the committee arranged three open events, and these received a large entry, and some well-known riders and runners competed. It was gratifying to the club, however, that their 100 yards champion, J. R. Tucker, won the 100 yards open event off the 6½ yards mark. The Silver Cup now becomes Tucker's absolute property, he having won the Championship for the past three years. The races were carried through without a hitch, and proved very interesting to the large number of people present, and the other most notable feature of the meeting was the defeat of Mr. E. H. Barnes, who had held the Mile Championship for the past five years. He was defeated by a very promising miler in Mr. R. H. Holboche. The Arc Works Silver Prize Band, which is proving a valuable asset to the club, enlivened the proceedings by playing some very fine selections under the conductorship of Mr. W. Hall. At the conclusion of the sports, the prizes were distributed by Mrs. Tufnell, wife of Mr. Carleton F. Tufnell, president to the club, and chairman of the company; others present were Mr. E. Reeves, managing director, with Mrs. Reeves, Mr. T. Britton, manager, Mr. and Mrs. H. Pensabene, Mr. and Mrs. H. J. Fell, Mr. P. Morgan, together with the chiefs of the departments at the works. A good party from the London office also attended, including Mr. A. E. Mohring. In the evening a fete was held, and a highly successful function was brought to a close by a grand display of fireworks. The arrangements were carried out by a most enthusiastic committee under the secretaryship of Mr. P. G. Cheverton.

On Saturday morning last, over 600 of the employés from the Witton Works of the GENERAL ELECTRIC CO., LTD., travelled by special train to Bournemouth on the occasion of the annual works outing. Favoured with beautiful weather, they spent an exceedingly enjoyable time, and did not return home until the early hours of Sunday. Owing to the difficulty of finding accommodation for lunching so large a party, the largest skating rink in the town was required. Lunch and tea were partaken of here under the chairmanship of Dr. Railing.

The seventh annual outing of ELECTRICAL INSTALLATIONS, LTD., took place on Saturday, June 20th, the party dividing themselves into two sections. About 30 left Cannon Street, E.C., by char-à-banc at 7.30 a.m., for Hastings, arriving just before one o'clock, and the remainder went by train to Southend-on-Sea. The weather was all that could be desired. The Southend party went for a brake ride round the country during the afternoon, and other pastimes, such as swimming and boating, were indulged in by both parties. The char-à-banc portion left for home about 5.30, arriving safely soon after 11.

Dissolutions and Liquidations.—THE UNIVERSAL BELTING CO., LTD.—This company is winding-up voluntarily, with Mr. J. A. Ashley, of 75, Currier Lane, Ashton-under-Lyne, as liquidator. A meeting of creditors is called for July 8th, at 8, St. James' Square, Manchester.

UITENHAGE ELECTRIC LIGHT AND POWER CO., LTD.—This company is winding-up voluntarily, with Mr. E. West, of 71A, Queen Victoria Street, E.C., as liquidator. A meeting of creditors is called for July 13th.

RUSHMORE LAMPS, LTD. (old company).—A meeting will be held at 27, Southampton Street, Strand, W.C., to hear an account of the winding-up from the liquidator, Mr. G. H. Cobley.

THE ROSSENDALE BELTING CO., LTD., Manchester.—Liquidator (Mr. E. D. Symond, Official Receiver) released June 12th.

GARRETT, HARTLEY & CO., LTD., electrical engineers, Morena Street Works, Morena Street, Catford, S.E.—Under a compulsory winding-up order made recently, the statutory first meetings of the creditors and shareholders were held on Monday, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. Proofs of debt were tendered as follows:—

John Russell & Co., Ltd.	£34
Sun Electrical Co.	100
Accles & Pollock, Ltd.	120
Watts, Fincham & Co.	21
Hartley, S.	345

The Chairman reported that the company was promoted only a year ago, with a nominal capital of £1,500, and Mr. Garrett had been carrying on the business of an electrical engineer for some little time; he had spent his capital in experiments, and on advertising for a partner, he was met by Mr. Hartley, who was willing to put £750 into the business. It was deemed best to convert the business into a limited company, which was to acquire the whole concern for £750, but the arrangement was entirely muddled, and Mr. Garrett was allotted 750 fully paid shares of £1 each, whilst Mr. Hartley received £350 in debentures and £400 in fully paid shares. He paid the money, or most of it, to Mr. Garrett; some question would doubtless arise as to the validity of his debenture holding, and if Mr. Hartley wished to evade responsibility for the bungling he would have to make an application for directions by the Court. It was stated that Mr. Hartley paid £500 cash to Mr. Garrett prior to the promotion, and £250 at the date of registration. Mr. Garrett had asserted that he spent the £500 in paying off the debts of the old business, and the £250 was used as working capital for the company. The gross turnover of the business appeared to have been just over £2,000 during the 11 months of its existence, and after charging £3 weekly for the vendors' salaries, a net profit of £193 was returned. The company's business consisted almost entirely of electric installation work for cinema theatres. Two contracts were running at the date of the winding-up order, but they had been terminated, and it was improbable that anything would be recovered therefrom for the benefit of the creditors and shareholders. The plant and machinery at the Catford works had been sold for £160, and book debts to the face value of £245 had to be collected. The liabilities were estimated at £616, exclusive of the debenture-holders' claims, which would in all probability absorb all the assets. By general consent the liquidation was left in the hands of the Official Receiver.

THE BRITISH POWER CO., LTD.—A meeting of creditors is called for July 9th, at 34, Coleman Street, E.C., by the liquidator, Mr. T. W. Holland.

Catalogues and Lists.—MESSRS. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—Pamphlet No. 546 (12 pages) gives illustrated particulars and prices of electric fans, sewing machine motors, small motor-generators for accumulator charging, polishing and buffing motors, and centrifugal fans. The range of fans extends from 10 in. diameter desk fan up to fans with box blades 4 ft. in diameter.

MESSRS. ISENTHAL & CO., Denzil Works, Neasden, N.W.—12-page pamphlet containing a full description of their "Grid"

type electrolytic rectifier for A.C. to C.C. This is the firm's latest form. Prices, dimensions, &c., are tabulated.

Messrs. Baxter & Caunter, Ltd., 219, Tottenham Court Road, London, W.C.—List of tabulated prices and other particulars of Aero table, desk and bracket ventilating fans for D.C. and A.C. also porthole type fans.

The British Thomson-Houston Co., Ltd., Rugby.—Price list No. 4,505 (12 pages) deals in the firm's usual illustrated and detailed manner with the B.T.H. aluminium lightning arresters for A.C. circuits. Price list No. 2,532 describes and gives prices, &c., of their pressed steel gear cases for tramway motors, which have been subjected to extensive tramway tests, and are now being placed on the market.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—Illustrated price list No. 384, for contractors' use, of electric lanterns for half-watt lamps, the designs being suitable for shop front, street and general outside lighting, and for large interiors.

Messrs. Edison Accumulators, Ltd., 2 and 3, Duke Street, Piccadilly, London.—New catalogue of 32 pages, giving illustrations as well as a great deal of information, including abridged specifications in tabular form, regarding their commercial electric vehicles, as supplied to various well-known stores and other business houses, also particulars relating to their operation and actual running costs. Edison accumulator industrial trucks are also included.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, London, E.—Section I Catalogue (No. 33), of 96 pages, containing a large amount of well-arranged and finely illustrated material describing a great variety of telegraph instruments—single needle instruments, sounders and pole changers, keys, relays, lightning protectors, galvanometers, detectors, resistances, condensers, vibrators, switches and commutators, Morse inking apparatus, Wheatstone apparatus and repeater and quadruplex sets. Prices are clearly shown.

Messrs. Boving & Co., Ltd., Union Court, Old Broad Street, London, E.C.—Small pamphlet of 32 pages containing descriptive and tabulated information relating to their standard low-lift Victoria turbo pumps up to 21-in. discharge. These pumps are now being used by the Indian, Egyptian and Soudanese Governments, the London County Council, and many Colonial and other municipalities.

Messrs. Alley & MacLellan, Ltd., Sentinel Works, Polmadie, Glasgow.—Well-bound catalogue of 160 pages, containing exhaustive particulars and excellent pictures of their "Sentinel" air compressors. It gives dimensions, weights, prices and full particulars, of air compressors of capacities from 25 to 25,000 ft. of free air per minute. In addition to this, it includes in the articles on air piping, air lift pumping, compressed air forge hammers, drying air, cooling air, &c., a large volume of practical data accumulated during the sale of over 2,000 "Sentinel" compressors. The firm have endeavoured in this catalogue to give practical, rather than theoretical data, making it more valuable to the practical man than the ordinary text books. Copies of the catalogue will be forwarded on application.

The Ostro Light Co., Ltd, 11, Queen Victoria Street, London, E.C.—Two illustrated lists: one, of 16 pages, gives prices and other information in table form respecting table, oscillating, cabin, ceiling, porthole and other types of electric fans; the other (No. 67) is a 24-page list of electric time and automatic switches and automatic switchgear.

Photography with Half-Watt Lamps. — The General Electric Co., Ltd., has sent us a copy of a booklet dealing with photography by Osram half-watt lamps, which explains in simple language how the best results can be obtained in portraiture. The half-watt lamp lends itself admirably to studio lighting, and it is found that quite short exposures suffice; the cost of energy is small, and the lamps need no attention. A great deal depends upon the proper arrangement of reflectors, and directions are given showing how these should be disposed; suitable G.E.C. reflector fittings are also illustrated. An important feature of the illumination is its similarity to daylight; this is emphasised in a letter to the *British Journal of Photography*, by a professional photographer, Mr. A. L. Jones, who finds the light very satisfactory in this respect; he points out also that while he did not care for the results obtained with direct illumination, completely indirect lighting proved more rapid than direct, and he has used this system constantly, for over 1,000 negatives. The 3,000-C.P. lamp is the best for the purpose. The light is also suitable for printing daylight papers. Excellent examples of portraiture with the Osram half-watt lamp are given in the booklet, which can be obtained by application to the company.

For Sale.—Leeds Electric Lighting Department have for disposal boilers, engines, alternator, pumps, pipes, &c., particulars of which are given in our advertisement pages to-day.

Bankruptcy Proceedings. — Mr. George Philip Malcolm Lee, electrical and marine engineer, 39, Victoria Street, Westminster, S.W.—The first meeting of creditors was held on Tuesday at the London Bankruptcy Court under a receiving order. Mr. F. C. Garton, Official Receiver, reported that it appeared from the debtor's statements that in October, 1910, he joined in partnership Mr. H. A. Harvey. They subsequently transferred their business to a company registered as H. A. Harvey & Co., Ltd., with a nominal capital of £60,000. As vendors they each received the Governor's share, 2,200 £1 preference and 12,000 1s. ordinary shares in the company. The debtor, in addition, was appointed chief engineer to the company at a salary of £550 per annum, which he enjoyed until the concern went into liquidation in May, 1913. He had also acted as director of other companies, and he attributed his failure to liabilities accepted in that capacity. The accounts showed liabilities £1,015, and assets consisting almost entirely of shares of uncertain value. In the absence of any offer, the case was left in the hands of the Official Receiver, to be wound up in the ordinary course of bankruptcy.

LIGHTING and POWER NOTES.

Aberdovey.—Proposed E.L.—The U.D.C. is communicating with the Charity Commissioners in connection with the use of water-power at Dolgach, for the purpose of supplying electricity to Aberdovey and Towyn.

Ardsley and Wombwell.—Lighting Scheme.—The Electrical Distribution of Yorkshire, Ltd., which has powers to supply electricity for lighting purposes in Ardsley and Wombwell, will be in a position to commence the supply about the beginning of August.

Argentina.—The Rosario City Council has authorised the municipality to draw up a specification and to call for tenders for public electric lighting. No restrictions are to be made in the present specification, as was the case in the last, which prevented several firms from tendering.

Concessions for electricity works have been granted to Messrs. Barberis Hermanos, at Sastre (Santa Fe), to Messrs. Orechia and Ratti, at Olivo (Cordoba), and to Messrs. Rufino Duque & Co., at Magdalena and Atalaya (Buenos Ayres).—*Review of the River Plate.*

Basingstoke.—E.L. Scheme.—Messrs. Johnson and Phillips, Ltd., have commenced laying mains in connection with the municipal E.L. scheme.

Belfast.—Year's Working.—There was a gross profit of £37,896 on the Corporation electricity undertaking for the year ended March 31st last, and a net balance of £12,798, compared with £13,175 in the previous year.

Blackpool.—Decorative Lighting.—The Electricity Committee has decided to illuminate the promenade and Princess Parade with vari-coloured electric lighting, including an electrically illuminated fountain, during the latter part of the summer season.

Owing to the bursting of the main steam valve at the electricity works on Monday last week, the supply of electricity was stopped for three-quarters of an hour.

Burnley.—Annual Report.—The report of the borough electrical engineer, Mr. James E. Starkie, on the past year's working of the Corporation electricity department states that the units sold totalled 5,399,113, including lighting, 1,090,678; power and heating, 600,673; and tramways, 3,707,672; against a total of 4,534,939 in the previous year. The net income amounted to £34,921, against £29,751, and working costs were £19,117, against £13,752. Of the net profit of £7,636, £5,550 was allocated to the relief of the rates, against £4,500 in the preceding year, and £2,087, against £3,426, to the reserve fund, which now stands at £25,026. The works costs per unit was 0·494d., and the gross cost, 1·212d. A H.T. alternating current supply is about to be introduced. Mr. Starkie states that the present station can only accommodate another 2,000-kw. set after the present extensions are completed, and is of opinion that a new station will be necessary in the near future.

Bury.—Annual Report.—In his report for the year ended March 31st, 1914, Mr. S. J. Watson, manager of the Corporation electricity department, states that the total output was 7,001,015 units, compared with 5,076,634 in the preceding year. The total includes power and lighting 4,096,041, against 2,936,804; tramways 1,604,603, against 1,370,266; and private lighting 622,239, against 548,181 units. Public lighting decreased from 77,976 units to 72,342. The average load factor was 25·9 per cent, against 22·4 per cent. There are 65 hired motors, equal to 648 H.P., and 641 privately-owned motors, equal to 4,337 H.P. connected. The total average price per unit was 0·95d., while the generating cost per unit was 0·47d. There was a gross profit on the year of £14,054, against £10,577. Interest and sinking fund absorbs £11,869, leaving a net profit of £2,185. During the year £7,182 was expended on new mains, services and transformers, and £1,593 on the Chamber Hall power station. The reserve fund now stands at £9,103.

Continental Notes.—Norway.—The Akershus County Council has decided to purchase the Raanaasfos waterfall, on the Glommen. The total cost was £58,300, and the Council has been authorised to take up a loan of £63,000 for the payment of the same. A Commission has been appointed to consider the most profitable manner in which the electrical energy can be utilised and distributed.

Austria.—According to the *Financial News*, the Brunn Municipality has obtained a 4,300,000 crowns loan, with the object of acquiring the majority of the shares in the electric company in the town.

Coventry.—The E.L. Committee has considered an application from the Daimler Motor Co. for a further supply of electricity in bulk, and has submitted terms.

Crook.—PROPOSED E.L.—The Ratepayers' Association has approached the Electric Distribution Co. in connection with an E.L. scheme, and the company has offered to lay a main through the town. Messrs. Pease & Partners have for some years electrically lighted certain districts and property by arrangement with the U.D.C.

Dundalk.—LOAN SANCTION.—The L.G.B. has sanctioned the application of the U.D.C. for a loan of £21,000 for the extension of the electricity works necessary to supply the locomotive sheds and premises of the Great Northern Railway Co. (I.). A 15 years' agreement has been sealed with the Railway Co., the estimated annual consumption being about 800,000 units. The extensions will be commenced at once.

Durham.—COLLIERY ELECTRIFICATION.—We understand that Messrs. Thomas Hedley & Bros., owners of the Craghead and South Moor Collieries, Chester-le-Street, have decided to electrify their group of collieries, and at the outset will install one, or probably two, 750-KW. mixed-pressure turbo-generators and underground pumps, together with electrical haulage. The scheme will be carried out to the designs of Mr. W. C. Mountain, who is also engaged upon a 750-KW. steam turbine plant at the Waleswood Colliery of Messrs. Skinner & Holford, Ltd. At this colliery a ventilating fan, large steam-driven air-compressors, and other machinery, are being installed. For the Sacriston Pit, Plawsworth, of the Charlaw and Sacriston Collieries Co., Mr. Mountain has an extension to the exhaust-steam turbine plant in hand.

Eastbourne.—L.G.B. INQUIRY.—Mr. H. R. Hooper held an inquiry last week into the application of the T.C. for sanction to a loan of £4,656, for the extension of the electricity undertaking. During the inquiry the amount was reduced to £4,000, and the odd £656 is to be raised out of revenue.

Eye (Suffolk).—PROV. ORDER.—The U.D.C. has been officially informed that the application of the Gas and Electricity Co. for a prov. order for E.L. will not be proceeded with. The chairman and the clerk, on June 26th, visited the B. of T. offices and discussed the question of electricity supply for the town; a report will be presented in due course.

Finchley.—ANNUAL REPORT.—The report of the borough electrical engineer on the past year's working of the electricity undertaking, states that it was a record in almost every respect. The income exceeded £20,000, and the working expenses decreased by about £500, compared with the previous year. The cost of production was 1·548d. per unit sold, against 1·577d. The units sold increased by 195,000, of which 60,000 were for power purposes. The gross profit was £12,033, and after paying interest charges, £3,642, and loan charges, £5,957, there was a net balance of £2,422, which, with £3,501 brought forward, was carried to the appropriation account. An oil engine set, costing £4,925, was installed during the year.

Frodsham.—ELECTRICAL PUMPING.—The Joint Water Committee has decided to introduce electrical power for pumping water and to install the necessary plant as early as possible. It is estimated that the annual cost of pumping by electricity will be £40 cheaper than by gas.

Grimsby.—WORKHOUSE LIGHTING.—The Lighting Committee has decided to extend the mains, at a cost of £60, in order to supply current to the workhouse.

Halifax.—NEW CHARGES.—The Tramways and Electricity Committee has extended the existing scale of charges for electricity for power purposes as follows:—In any quarter when the units consumed per H.P. demanded are 550 and under 750, ¾d. per unit; in any quarter when the units consumed per H.P. demanded are 750 and upwards at rates to be approved by the Committee.

YEAR'S WORKING.—A profit of £10,698 was made on the working of the Corporation electricity undertaking for the year ended March 31st last.

Hoylake and West Kirby.—YEAR'S WORKING.—The net profit on the U.D.C.'s undertaking for the year ended March 31st last was £360, and the available balance now amounts to £2,142.

Walsall.—Mr. E. M. Lacey has been retained by the T.C. to prepare the necessary plans and specifications in connection with the scheme for the extension of the electricity works.

Keighley.—ANNUAL REPORT.—As last year, the report of Mr. Webber, the borough electrical engineer, contains much information in readable form relative to the rapid progress being made in electrical matters in his town. In particular a comparison is made between 1914 and 1910, it being during this period that electricity at cheap rates has been available in the town. In 1910 rather over a million units were sold, including 612,000 for motor driving; the average revenue obtained was 1·69d. per unit, and the total working and financial cost was 1·73d., thus showing a deficit on the year. In 1914 some 4,325,000 units were sold, including 3,664,000 power units; the average price fell to ·87d. per unit, but the "all in" cost fell to ·79d. per unit, thus showing a profit of £1,204 on the year, and vindicating the policy of the engineer and Committee in providing cheap units for the power requirements of the numerous works in the district. The load during the year was taken by the turbine plant in connection with which a water tower, holding 150,000 gallons, has been erected to safeguard the condensing plant. One 2,000-KW. and two 1,000-KW. turbines are installed, and Mr. Webber has advised that a further 4,000-KW. turbine unit should be installed for next winter, although the matter has been deferred by the T.C. Some 15 high-tension and 28 low-tension supplies are given to large power consumers on five or 10-year agreements, and exclusive of traction, some 4,060 H.P. of motors are connected to the mains. In addition to the local mill and traction requirements, the department is now supplying the neighbouring town of Bingley, and negotiations are on hand for supplying the outlying D.C.'s of Haworth, Oakworth and Oxenhope, for which districts E.L. provisional orders are being applied for.

London.—BETHNAL GREEN.—The B.C. has, on the recommendation of Sir John Snell, appointed Mr. Harold W. Couzens, as consulting engineer in connection with its electricity scheme, at a fee of £5 per cent. on the capital cost, excluding the cost of land and buildings.

SOUTHWARK.—The B.C. has decided to take up at once a loan of £10,087 from the L.C.C. for electricity purposes, and also one of £1,200 for the acquisition of property for the extension of the Penrose Street generating station.

MARYLEBONE.—The Finance Committee has recommended the L.C.C. to sanction the application of the St. Marylebone B.C. for a loan of £5,524 for electrical plant.

Margate.—The Entertainments Committee has decided to have the Queen's bandstand and grounds illuminated by electricity.

Newmarket.—PROPOSED WORKHOUSE LIGHTING.—The B. of G. has referred to a committee a communication from Mr. F. A. Simpson, of the electricity works, asking for permission to submit an estimate for wiring the workhouse for E.L. The Board desires to obtain Mr. Simpson's terms.

Nelson.—BULK SUPPLY.—The T.C. has renewed the agreement with the Brierfield U.D.C., for a bulk supply of electricity to the latter for seven years, from July 1st, 1914.

Nuneaton.—LOAN SANCTION.—The T.C. has received sanction to borrow £7,000 for the purposes of the electricity undertaking, including £5,000 for plant, £1,500 for mains and services, and £500 for other extensions.

The Council last week considered the question of supplying current in the Stockingford district, and the matter was again deferred.

Port Glasgow.—PROPOSED NEW STATION.—The Clyde Shipbuilding and Engineering Co. has decided to erect an electricity station, and plans have been approved by the local authority.

Redruth.—STREET LIGHTING.—The Lighting Committee has recommended the U.D.C. to accept the terms of the E.S. Co. for public lighting, subject to new lamps being erected free at distances not exceeding 100 yards, in the extended residential area of the town, and maintained by the company at £2 4s. each per annum.

Salford.—NEW RATES.—The Electricity Committee has approved various new charges for electricity, to come into force in October next. For lighting it is proposed to charge flat rates of 3½d. per unit in Salford, and 4d. in Prestwich. For power a sliding scale ranging from 2d. to ·9d. per unit, according to quantity, and an alternative of £5 per KW. demand per annum, and ½d. per unit are proposed. New contract rates under 10-year agreements, provide for maximum demands between 25 and 200 KW., with charges varying from £4 10s. per KW. demand, plus ·3d. per unit, to £3 10s. plus ·25d. per unit. Special lighting rates to power consumers vary from 3d. to 1½d. per unit. Supplies in the Prestwich area are charged 12½ per cent. extra.

South Africa.—The Robertson (Cape Province) Municipal Council has been authorised to borrow £10,000 for an electricity installation.—*African World.*

Tasmania.—The Government has signed a contract for the purchase of the Hydro-Electric Co.'s works at Great Lake. The contract is to be submitted to shareholders of the company for approval, and will then have to be ratified by Parliament.

Torpoint.—PROPOSED E.L.—The E.L. question was again discussed by the U.D.C. on June 25th, when it rescinded the former resolution, which held that the E.L. Co. had withdrawn from the agreement, and desired to renew the contract with the company in its entirety, subject to a guarantee of £100 instead of £50, as formerly. A member gave notice that at the next meeting he should move that this resolution be rescinded!

Truro.—E.L. SCHEME.—The T.C. having decided in favour of Dr. Purves's scheme for E.L. in the town, application is to be made to the L.G.B. for sanction to a loan of £10,000 for the undertaking, and tenders for plant, mains, &c., are to be invited.

Whitstable.—SEWAGE PUMPING.—The U.D.C. has received the consent of the L.G.B. to an agreement with the E.L. Co. for electrical pumping at the sewage works.

Willesden.—Proposed Loans.—The Electricity Committee has received a letter from the L.G.B. suggesting that it would be preferable to meet expenditure on meters out of revenue, rather than by loans. The Committee concurs, and has paid out of revenue £2,574 for meters, but the undertaking is making such progress that it is deemed desirable to take up a loan, although for a short period only. The Committee accordingly recommends the U.D.C. to request the Board to sanction a loan of £2,000.

The Committee also recommends that application be made for sanction to a loan of £25,000, including building, £170; machinery, £1,000; mains, £15,000; services, £5,000; public lighting, £330; meters and indicators, £3,500. The electrical engineer is of opinion that it will soon be necessary to extend the mains in the Cricklewood district, involving an expenditure of about £6,000.

The B. of. G. has received a letter from the L.G.B. suggesting that it should terminate its agreement with the Council for the supply of electricity to the workhouse infirmary, on the ground that, having abandoned its own generating plant, the Guardians had lost the benefit of the exhaust steam therefrom, involving an additional expenditure of £400 per annum. The chairman of the Electricity Committee, together with the clerk and the electrical engineer, have interviewed the Guardians on the subject, and discussed the question of using the plant at the infirmary for a stand-by supply. The Committee has considered a report of the electrical engineer on the matter, but before taking further action, proposes that he should interview the Engineering Inspector of the L.G.B., with a view to a further inquiry being held by him, at which the Council may be represented.

The Electricity Committee recommends the substitution of new flame arc lamps for those of the open type in four roads.

TRAMWAY and RAILWAY NOTES.

Australia.—The South Melbourne (Vic.) Council has decided to construct an electric tramways system from Princes Bridge, through South Melbourne, to Middle Park, at a cost of £64,000.—*Australian Mining Standard.*

Bradford.—Year's Working.—Compared with the preceding year, the profit of the Corporation's tramway department for the year ended April 30th last, decreased from £41,900 to £29,500. The total revenue was £305,700, an increase of £17,500, and the car-mileage was 6,206,000, against 5,930,000. Working expenses increased as follows:—Track renewals, £3,000; car renewals, £10,500; wages, £7,000. Energy cost £50,000, or just under 2d. per car-mile. Interest and sinking fund charges amounted £52,000, and £10,000 against £17,000 in the previous year, was allocated to rate relief. The reserve fund now stands at £73,000. The railless traction system at Dudley Hill showed a loss of £414, against £380, and the parcels department showed a profit of £850, against £1,060.

Continental Notes.—France.—A writer in the *Revue Industrielle* on the subject of the electrification of the railways in France, details the lines that have been converted, those that are in course of construction, and those that are under consideration, summing up the particulars with the remark that they show France to be only making slow progress with railway electrification.

So far as the French State Railways are concerned, the electric lines now in operation include:—Paris-Invalides to Perpigan, 10 km.; Paris to Auteuil, and Champs de Mars, 14 km.; Paris to Versailles, 26 km.; St. Cloud to Etang-la-Ville, 16 km.; Paris to St. Germain, 23 km.; and Asnieres to Argenteuil, 5 km.; a total of 94 km. (59 miles).

The Paris, Lyons and Mediterranean Co. has in operation a line between Le Fayet, Chamonix and Vallorcine, 36 km.; the Orleans Co., the Paris-Juvisy line, 23 km.; and the Midi Co., the Perpigan-Bourg Madam line, 103 km. and others from Montrejeau to Luchon, 36 km.; from Lannemezan to Arreau, 26 km.; from Tarbes to Bagnere-de-Bigorre, 22 km.; from Montrejeau to Pau, 112 km.; from Lourds to Pierrefitte, 21 km.; from Pau to Bedous, 60 km.; and from Buzy to Laruns, 19 km. It will be seen from the foregoing that the Midi Co. has shown the greatest enterprise in connection with railway electrification in France, for out of the 560 km. (350 miles) open, no less than 399 km. (249 miles) are on the Midi system.

At the present time, 155 km. of new electric railways are in course of construction, viz., Auch-Lannemezan, 38 km.; Castelnau-Magnoac-Tarbes, 52 km.; Arreau-St. Lary, 11 km.; and Hagetmau-Pau, 54 km. A further 128 km. (80 miles) of electric railways are awaiting Government sanction before the work of construction is taken in hand, viz, Quillan-Belesta, 26 km.; Villefranche-Vernet les Bains-Sahorre, 9 km.; Montlouis la Cabanasse-Quillan, 87 km.; and Bourg Madam to the Spanish frontier, 6 km.

Germany.—Electric Vehicles.—According to the Census of Production lately issued by the German Government, 291 private, and 122 industrial, electrically-propelled motor vehicles were constructed in that country during the year 1912.

The authorisation certificate for the proposed underground and elevated electric railway between Gesundbrunnen and Neukolln, Berlin, has been granted to the A.E.G. According to the certificate, the railway is to be of the elevated type for a distance of 97 mile in the north, whilst the length to be built in tunnel is 4 8 miles, and is to be completed by September 30th, 1918, under a penalty of £10,000 for any delay. A penalty of up to £5,000 is also provided for in the event of the working of a line being interrupted or suspended without sufficient reason. The speed is not to exceed 31 miles an hour. The fares can be fixed by the company for five years after the opening of the railway, but after that period the supervising authorities will have the right of settling the maximum fares.

Dundee.—Proposed Tramway Purchase.—A Special Committee of the T.C. has agreed to offer £8,500 for about a mile of the Dundee and Broughty Ferry Tramway Co.'s system, situated between the city boundary and Belsize Road. This includes track, overhead equipment, &c., and the company recently offered to sell it for £15,486.

Glasgow.—Annual Report.—The report of the past year's working of the Corporation tramways department has just been issued, and contains the following figures in addition to those in our issue of June 5th. The income was £1,083,846, and the expenditure £676,277, against £1,011,543 and £619,346 in the previous year, while the net balance credited to the common good account was £53,892. Notwithstanding the increase in car-mileage and the greater number of cars now upon the routes, the earnings per car-mile were more than in any previous year. The department paid £73,858 in local rates during the year. The outstanding debt is 2½ million pounds, including over 2 million pounds which had been borrowed from the depreciation fund, and the actual net debt had been reduced to about £400,000.

Halifax.—Proposed Extensions.—The Tramways Committee has appointed a sub-committee to consider the question of tramway extensions to Elland and Stainland.

India.—The Mysore Government Railway Board has decided to install E.L. in all carriages on the State-worked systems, the change being brought about gradually.

London.—L.C.C. Annual Report.—The total income of the L.C.C. tramways department for the year ended March 31st, 1914, amounted to £2,268,668, and the working expenses to £1,615,456. After paying interest charges, £328,109, debt redemption £408,488, income-tax £28,197, and sundry charges, making a total of £776,881, from which £25,153 has to be deducted on account of tax deducted, rent, &c., there is a deficiency on the year's working of £88,526, which has been met out of the reserve fund. The renewals fund, which stood at £539,749, has not been added to. The total running expenses per car-mile were 6·5d., compared with 6·62d. in the previous year, and the receipts were 9·21d. per car-mile, against 10·04d., for electric traction, and 8·15d., against 8·73d. for horse traction. The total passengers carried numbered 522,952,640, and the car-miles run totalled 59,209,289. The total capital expenditure is now £13,028,120, of which £409,277 was incurred during the past year, and the net indebtedness of the undertaking is now £9,923,528. In its report to the Council, the Highways Committee states that many lines recently electrified are not of a highly remunerative character, and have been very costly to construct, but the Committee's policy was influenced by housing and other considerations. The tramways also suffered through being unable on many occasions to carry passengers to the required destination, and a comprehensive linking-up scheme is recommended. Referring to motor-omnibus competition, the report states that the Council last year paid £86,337 in rates on the permanent way, to which the 'buses are not subject, and estimates that the annual saving to the road authorities consequent on the obligation of the Council to maintain the paving along its routes, is £128,000. The extra cost of bituminous grouting necessitated by the damage from rubber-tired vehicles is estimated at £20,000 a year. In respect of street improvements, the undertaking has been debited with a total of £800,575, of which £148,259 remains to be charged. During the year £124,259 was charged in respect of rates on track and buildings, £104,801 for permanent way repair, and £31,168 for street widenings, and the rates were, therefore, relieved to the extent of £260,228. The total amount per vehicle paid annually to the public funds, including licences, rates, taxes, road maintenance, &c., is stated to be £37 4s. 6d. per 'bus, and £187 10s. per tramcar, or, on the basis of £100 of gross receipts, £2 6s. per 'bus and and £11 1s. per tramcar. 52,754,604 passengers were carried at workmen's fares. In conclusion, the report states that it is clearly impossible, under existing conditions, to do away with the tramways, and recommends that every possible step be taken to improve the position of the undertaking, particularly in the direction of linking-up the system.

L.C.C.—The estimates for 1914-15 include the following working expenses £1,803,520, including renewals fund, £160,250; passengers estimated at 600 millions; total working surplus, £706,530, from which is to be deducted debt charges, £736,091, and income-tax £17,121, leaving a net estimated deficiency of £46,682; and to be expended on capital account, £965,915.

During the discussion on the report at Tuesday's meeting of the Council, an amendment by Sir John Benn that the Highways Committee should prepare a scheme for linking-up the "dead ends" on the system, was defeated.

The B. of T. has appointed a court of arbitration to decide upon applications received by the Electrical Conciliation Board for the revision of the wages of certain sections of the employés of the L.C.C. tramways department.

The Highways Committee recommends the Council to remove the overhead equipment and reconstruct the tramways in part of Seven Sisters Road on the conduit system, by direct labour under the supervision of the Committee, at a cost of £16,450.

In order to relieve the traffic at the southern end of Blackfriars Bridge, the Committee recommends that a third track be installed between the Bridge and Stamford Street, at a cost of £3,500, the trackwork, at a cost of £1,350, to be obtained from Messrs. Hadfield's.

It also recommends that a tramway lay-by be installed in High Street, Plumstead, at a cost of £1,115.

Oldham.—Expiring Tramway Lease.—The lease of the Oldham, Ashton, Hyde and Denton Electric Tramways Co. shortly expires, and the question of the local authorities acquiring the undertaking is under consideration. A meeting of the various authorities is to be held on July 8th to consider what action they shall take in the matter.

South Shields-Sunderland.—Proposed Linking-Up.—In connection with the proposal of the South Shields Tramways Committee to link up its tramway system with that of Sunderland T.C., a joint meeting of the Sunderland and South Shields Tramway Committees has decided that Mr. W. T. Robson and Mr. A. R. Dayson, managers of the respective undertakings, shall inspect and report on three suggested routes.

Stalybridge.—Proposed Extensions.—The Tramways and Electricity Board has decided that, in the event of further Parliamentary powers being applied for, the following provisions be included in the Bill:—Power to purchase, lease or inter-run with neighbouring tramways; to extend the system to Woolley Bridge and to Greenfield; to run omnibuses; and to make the Board a trust investment.

TELEGRAPH and TELEPHONE NOTES.

All-British Cable to Australasia.—At the sitting on Friday last of the Dominions Royal Commission, Mr. Stanley J. Goddard, European representative of the Western Union Telegraph Co., gave evidence concerning a suggestion which had been made, that it might be possible for his company to lease to the Governments concerned one of its existing Atlantic cables connecting Great Britain with the North American Continent, and to arrange to operate it by British subjects on British territory on behalf of the Governments. He said he had communicated the suggestion to Mr. Newcomb Carlton, president of the company, and that Mr. Carlton saw no insuperable objection to such a proceeding, as a general proposition, subject to the company's interest being properly protected. The "line" would be leased from London to Montreal, where it would connect with a line worked by the Pacific Cable Co. for Australasia. The line would be for "general purposes," and would ensure communication between England and Australasia being entirely on British territory and worked by British subjects.

Cable Tariffs.—The Indo-European Telegraph Co., Ltd., gives notice of reductions in the tariff for Press telegrams to all Eastern countries that are served by the "Indo" route, amounting to 50 per cent. or more.

Dublin.—By the terms of an agreement arrived at between the parties, legal proceedings have been stayed in an action in which the Postmaster-General sought to restrain the Dublin Corporation from interfering with the construction of certain underground telephone lines in the City of Dublin. The Corporation contended that it was entitled to the payment of wayleave by virtue of an agreement entered into with the National Telephone Co., but the Postmaster-General held that he was not bound by an agreement with a company which had ceased to exist.

The Imperial Chain.—In reply to questions in the House of Commons, Mr. Hobhouse stated that several of the masts of the home station had been erected, and a considerable quantity of material had been sent out to Egypt; material was also about to be dispatched to the stations in East Africa, India and Singapore. The Post Office was not in a position to undertake the work of erecting the second three stations; but the Government could cancel the contract with the Marconi Co. for those stations, and was prepared to consider the employment of other contractors, subject to the practical demonstration of the efficiency of their system. No such demonstration had yet been given. Sites for stations had been acquired in England and Egypt, but not elsewhere, though the Government knew approximately where the others would be.

The Telephone Service.—The Post Office is gradually closing the trunk exchanges, and transferring the operation of the trunk lines to the local exchanges, thus expediting the service. Underground cables are being laid between the large manufacturing centres of the North which lie close together, with many more wires than the existing overhead lines, and this also will improve the trunk service. By the end of the month it is hoped that underground communication between London and Liverpool *viâ* Birmingham will be available; this is the longest loaded line yet laid down in this country for telephonic purposes. The trunk service between Manchester and Liverpool is now so satisfactory that the Manchester Royal Exchange and the Liverpool Cotton Exchange, which had hitherto used private telephone wires direct from one to the other, have asked to be relieved of their agreement with the Post Office.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—August 31st. Sydney Harbour Trust. Four electrically-operated semi-portable travelling cranes. Forms of tender from Mr. H. F. Norrie, Secretary to the Trust, Sydney.

Perth.—August 12th. Cable, lead-covered and various, for Postmaster-General. See "Official Notices" to-day.

August 12th. Insulators, for Postmaster-General. See "Official Notices" June 12th.

August 19th. Electric lamps and fittings, for Postmaster-General. See "Official Notices" to-day.

August 19th. Telephone switchboards, galvanised iron and steel stranded wire, for Postmaster-General. See "Official Notices" to-day.

September 2nd. Telephone instruments and parts, glassware, battery material, chemicals for batteries, wire—cotton, silk or wool covered—telegraph and telephone insulators, for Postmaster-General. See "Official Notices" to-day.

October 7th. Victorian Railway Commissioners. Four motor-driven air compressors and electrical equipment (motors, &c.) for the new workshops at Ballarat and Bendigo. Specification may be seen at the Board of Trade Commercial Intelligence Department in London.

Aylesbury.—July 6th. U.D.C. Lighting and power switchboard with connections, battery of accumulators, underground mains, including house services, conversion of existing lamp standards, &c. See "Official Notices" June 12th.

Ballaghadereen.—July 6th. Hydraulic turbine and accessories, dynamo and reducer set, aerial line and switchgear, for the Electricity Committee. See "Official Notices" June 19th.

Belgium.—July 7th. The municipal authorities of Lokeren are inviting tenders for the concession for the supply of electrical energy for lighting and power purposes in the town.

Blackrock.—July 13th. U.D.C. Underground mains, overhead mains, feeder pillars and public lighting. See "Official Notices" June 26th.

Bolton.—July 19th. Corporation. Converting plant, sub-station E.H.T. and H.T. switchgear. See "Official Notices" June 12th.

Erith.—The U.D.C. has decided to invite fresh tenders for the supply of coal for the electricity works, owing to the fact that one firm tendering felt that they had been unfairly treated with regard to the publication of the figures of the tests applied to the samples.

France.—July 17th. The French State Railway authorities (Bureaux du Service Electrique, 3me Division) in Paris (72, Rue de Rome) are inviting tenders for the supply of 100 continuous-current motors for railway traction purposes. Particulars may be obtained from the address given.

Gillingham (Kent).—July 17th. B.C. 12 months' supply of coal for the Electricity Department. Specification from the Borough Electrical Engineer, Gillingham Road.

Lancaster.—July 13th. Coal and slack for 6, 9 and 12 months respectively for the Corporation Electricity Works. Mr. G. C. Milnes, Marton St. Works.

London.—L.C.C. July 13th. One, two or three electrically-driven chassis, for Fire Brigade. See "Official Notices" June 19th.

July 14th. Five rotary converters of 1,500 kw. each, 15 main static transformers, two starting static transformers, and re-erection, &c., of existing motor generators. See "Official Notices" June 19th.

July 30th. 10,000 or 5,000 driving and pony wheel tramcar tires, 300 axle forgings for tramcars. Chief Officer, Tramways Department, 62, Finsbury Pavement, E.C.

July 7th. Three years' supply of electrical accessories. See "Official Notices" June 19th.

The Highways Committee recommends that tenders be invited for four portable electrically-driven grinding and drilling machines for use on the permanent way in connection with the Council's tramways.

Hackney.—July 9th. B.C. 80,000 pairs open-type white arc lamp carbons, and 100,000 pairs yellow-flame arc lamp carbons. See "Official Notices" June 26th.

Madeira.—The General Council of Administration of the district of Funchal, on the Island of Madeira, are at present inviting proposals for the establishment of a central electricity generating station for the supply of the current required for the operation of a system of electric tramways in the town and district of Funchal.

New Zealand. — AUCKLAND. — August 6th. Three 750-KW. D.C. mixed-pressure turbo-generators; one 1,500-KW. three-phase turbo-generator, including auxiliary plant and sub-station equipment. See "Official Notices" May 22nd.

July 31st. Seventy three-phase A.C. motors, including four 150-B.H.P., one 100-B.H.P., and eight 75-B.H.P., for the Dominion Portland Cement Co. Specifications from E. W. Hunt, secretary, Johnston Street, Wellington, or S. I. Crookes, Consulting Engineer, Auckland. Particulars may be seen at the Commercial Intelligence Branch of the Board of Trade in London.

Paisley.—July 6th. Corporation. Coal for the Electricity Committee. Particulars from Mr. C. F. Parkinson, Engineer and Manager.

Pittington (Durham). — July 11th. Poles, lamps, cables, &c., for the Parish Council. Specification from Mr. T. Carson, Clerk.

Ramsey (Hunts).—July 6th. Public lighting, for the U.D.C.; Mr. R. F. Serjeant, Clerk.

Rotherham.—July 8th. Corporation. Tramway stores, coals, cables, meters, &c. See "Official Notices" June 19th.

Skegness.—July 6th. U.D.C. Repair and maintenance of private telephone to waterworks for five years. Forms of tender from the Clerk to the Council.

Thorne (Yorks.)—July 6th. Public lighting, for the P.C. Mr. C. Waller, Clerk.

Truro. — July 4th. Electrical contractors who are desirous of tendering for the proposed municipal electric light plant, particulars of which appear in our advertisement pages, are invited to communicate with the Town Clerk not later than to-morrow, July 4th. See "Official Notices" to-day.

Walsall.—July 14th. Corporation. Four water-tube boilers, superheaters, economisers, pumps, pipes, &c. See "Official Notices" June 19th.

July 14th. Corporation. Two 3,000-KW. turbo-alternators with surface condensers, motor generator. See "Official Notices" June 19th.

Warrington.—July 8th. Corporation. High and low-tension cable. See "Official Notices" June 26th.

West Ham.—July 20th. Lighting installation at Rosetta Road School, for Education Committee. See "Official Notices" June 26th.

Whitstable. — July 17th. U.D.C. Electric motors, switches, &c., at the sewage pumping station. Specifications from Messrs. Strachan & Weekes, 9, Victoria Street, S.W.

York.—July 13th. Corporation. 500-KW. rotary converter, with transformers and switchgear. See "Official Notices" to-day.

CLOSED.

Australia.—The following contracts have been placed:—

P.M.G.'s Department, South Australia:—

200 c.b. telephones, wall-pattern, £4 5s. 3d. each; 100 ditto, table-pattern, £4 2s. 8d.; 50 cable terminals, £2 15s. 9d. each.—Western Electric Co. (Aus.), Ltd.

880 yd. switchboard cable, £147; 440 yd. ditto, £47.—Australian Metal Co., Ltd.

Victorian Railways Department:—

One 125-K.V.A. three-phase alternator, £573.—British G.E. Co., Ltd.; Electrical apparatus for McBride's Tunnel, State Coal Mines.—Australian G.E. Co.

Victorian Public Works Department:—

Electric lighting plant, for Williamstown Shipyard, £317.—Gardner, Waern & Co.

N.S.W. Railways Department:—

30 miles trolley wire, £2,744.—Cameron & Co.

N.S.W. Public Works Department:—

Two electric passenger lifts, for Public Instruction Department's offices, £1,916 and £1,450.—Standard Waygood Hercules, Ltd.

Sydney Municipal Council:—

Outdoor transformers, 20-50 K.V.A. and 100 K.V.A., £2,593.—Standard Waygood Hercules, Ltd.

100 and 300 K.V.A. indoor transformers, £1,802.—Noyes Bros.

For Phillip Street Sub-station (Sydney):—

Storage battery, £32,948.—Australian Metal Co., Ltd.

Running machinery, £10,581.—N. Guthridge, Ltd.

Switchgear, £7,145.—Australian G.E. Co.

Shire of Gisburne:—

Power station equipment, £1,100.—I.R., G.P. and Telegraph Works Co., Ltd.

Commonwealth:—

Electric light installation at Jervis Bay Naval College, £1,422.—W. Cumming, Melbourne.

A.C. generator, for Canberra power station, £1,545. — Brush Electrical Engineering Co., Ltd.

—*Australian Mining Standard.*

Barking. — The U.D.C. Electricity Committee has accepted the tender of Messrs. Phillips & Co., for an annual supply of Geddling high hazel ½-in. slack, at 11s. per ton; also the tender of Messrs. Myers, Rose & Co., Ltd., for a similar supply of Griff, 1½-in. nutty slack, at 12s. 3d. per ton.

Belfast.—The T.C. has accepted the tender of the British Westinghouse Co., for a rotary converter, at £2,003.

Belgium.—Seven concerns—six German and one Belgian—submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of a quantity of telephone cables and accessories, the lowest (£6,160) being that of the Société A.E.G. Union Electrique, of Brussels.

Bristol.—The Electrical Committee has placed the following contracts for 1914-15:—

Oliver Arc Lamp, Ltd.—Oriflamme yellow flame arc lamp carbons, £315.
Sykes & Sugden, Ltd.—Joint boxes, £446.
W. Lucy & Co., Ltd.—Fuse boxes, £154.
British Westinghouse Co., Ltd.—Meters (alternating current), £1,347.
Sloan Electrical Co., Ltd.—Open type white arc lamp carbons, £389.

Canada.—The Toronto Board of Works has awarded to Messrs. A. & P. Steven, Glasgow, the contract for an electric passenger elevator for the City Hall, at a cost of $4,300.—*Canadian Engineer.*

Dover.—For the supply of electrical pumps in connection with the Pier scheme drainage works, the T.C. received the following tenders:—

Turbo Electrical Co., London.—Accepted (69 H.P.), £750.
British Thomson-Houston Co., Ltd.—58 H.P., £754; 60 H.P., £849; 56 H.P., £814; 56 H.P., £902.
Tangyes, Ltd.—60 H.P., £890.
Worthington Pump Co.—62 H.P., £806.
Pooley & Austin.—62 H.P., £816.
Boving & Co.—54 H.P., £826.
Stereophagus Pump Co.—75 H.P., £1,025.

Halifax.—Mr. J. T. Murray, of Halifax, has secured the contract for the E.L. installation at the new Congregational Church at Highroad Well.

Heston-Isleworth.—The following tenders have been accepted by the U.D.C. for annual supplies of coal to the electricity works:—

Albert Usher & Co.—500 tons Coleorton hard steam, 15s. 3d. per ton, at Brentford Docks, 16s. 2d. per ton at Hounslow Station.
Wm. Cory & Co.—500 tons Brynteg anthracite, 19s. 11d. per ton at the docks.
Charrington, Sells, Dale & Co.—60 tons Bestwood brights, house, 19s. 2d. per ton at the docks.
Albert Usher & Co.—2,100 tons Mapperley or Readings bituminous nutty slack, 12s. 2½d. per ton at the docks, 13s. 5d. at station, 14s. 3d. at the works.

Kingston-on-Thames. — The tender of Messrs. Wm. Cory & Son, Ltd., has been accepted by the Council for an annual supply of about 2,800 tons of either (or both) Maude rough, at 13s. per ton, and Lampton rough, at 14s. 4d. per ton. Twenty-four tenders were received.

London.—L.C.C.—The Highways Committee recommends that the special trackwork required in connection with the reconstruction on the conduit system of the Seven Sisters Road tramways and for the installation of a third tramway track between Stamford Street and Blackfriars Bridge, be obtained from Hadfields, Ltd., at costs of £945 and £1,350 respectively.

METROPOLITAN ASYLUMS BOARD.—Installation of telephones and domestic bells, &c., at the Orchard Hospital:—

Electric Installations, Ltd. (accepted)	£510	Pinching & Walton	£630
Brit. Home & Office Telep. Co.	460	Alpha Manufacturing Co. ..	705
Turnham & Co.	543	Tyler Apparatus, Ltd.	777
Lund Bros. & Co.	544	G. Weston & Son, Ltd. ..	1,117
J. and F. May & Co. ..	589	(The engineer-in-chief's estimate	
T. W. Vaughan & Co. (1914), Ltd.	610	was £535.)	

SOUTHWARK.—The B.C. is recommended to accept the tender of Sir W. G. Armstrong, Whitworth & Co., Ltd., at £625, to provide and fix a horizontal electrically-driven force pumping engine at the Manor Place depôt.

The London Education Committee has received the following tenders for installing electric lighting, bells and telephones at the Furzedown Training College and Hostels:—

Turnham & Co. (recommended)	£1,050	Alpha Manufacturing Co.	£1,746
Tyler Apparatus Co., Ltd. ..	1,284	Malcolm & Allan, Ltd. ..	1,761
Arthur Newman, Ltd.	1,499	Cox-Walkers, Ltd.	1,865
G. Weston & Sons, Ltd. ..	1,503	Buchanan & Curwen ..	2,056
Lund Bros. & Co.	1,589	C. H. Cathcart & Co. ..	2,425
Defries & Goldman	1,565	Frederick Hodgson & Co.	2,800
Tredegar & Co.	1,729		

The tender of the Anglo-Colonial Engineering Co., Ltd., for the supply of 13,000 carbon filament lamps, has been accepted by the Royal Mail Steam Packet Co.

Margate.—The T.C. received the following tenders for an electric sign for the Pavilion and Winter Gardens:—

A. F. Goodwin & Co. (accepted)	£69	Kingston & Co.	£109
Siemens Bros.	74	Franco-British Electrical Co. ..	110
Watlington & Co.	80	Tyler Apparatus Co.	£120 and 130
Philpott & Son	92		

Rugby.—The U.D.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a distribution panel, and that of W. T. Henley's Co., Ltd., for cable.

Salford.—The T.C. is recommended to accept the tenders of the British Westinghouse Co., at £14,137, for a 5,000-KW. turbo-alternator, and, at £770, for an auxiliary steam turbine, directly coupled to an air-pump and an extraction pump, together with accessories.

The following tenders have been accepted by the Electricity Committee for annual supplies:—

Doulton & Co.—Stoneware conduits, £280.
G. Hanchett Barratt & Co.—Lighting transformers, £200.
British Electric Transformer Co.—Lighting transformers, £68.
Baxendale & Co.—W.I. steam tubes and fittings, £37.
H. Green & Co.—Electric motors, £1,092.
General Electric Co.—Electric motors, £204.
Electrical Engineering and Equipment Co.—L.T. three-core cable, £500 (provisionally).
W. T. Glover & Co.—L.T. three-core cable, £500.
Johnson & Phillips.—Copper strip, £2.
Price & Co., Ltd.—Turbine oil, £56.
G. S. Morris & Sons.—Graphite cylinder oil and cylinder oil, £58 and £150 respectively.
Bell Bros.—Crank chamber oil, £450.

Stoke.—The following tenders have been received by the Guardians for wiring the children's hospital:—

J. Richards & Co.	£138
Howell & Co.	210
Barnett & Soans	141
Blackburn, Starling & Co.	160

The following tenders have also been received for the installation of internal telephones and bells:—

L. Vaughan	£209
E. M. Evans	317
J. Richards	187
Blackburn, Starling & Co.	299
Staffs. Telephone Co.	195
Barnett & Soans	213
Dargue, Griffiths & Co.	364
Howells & Co.	321
Baggaley & Son	260

The tender of J. Richards has been accepted in both cases.

Stretford.—Mr. Bertram Thomas, who secured the contract for the electric lighting at Trafford Park School, asked that the contract should be cancelled, as a serious mistake had been made in his tender. The Education Committee agreed.

The Committee has since accepted the tender of Mr. Charles Cooper, of Stretford, at £336.

Tunbridge Wells.—The tender of Messrs. Isaac Storey and Sons, at £216, for refitting the old condenser at the electricity works is recommended.

Wimbledon.—The Corporation Electric Lighting Committee recommends the acceptance of the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for switchgear, for the new 1,500 KW. turbo-alternator at the Electricity Works, for £152.

For the supply of coal for 12 months, for the Electricity Works, 15 tenders were received. The Committee recommends the acceptance of the tender of Messrs. E. Foster & Co., for 5,000 tons of "Kingsbury Ryder" small nuts, at 16s. 9d. per ton, and 6,000 tons of Ibstock (deep seam) double-screened nuts, at 16s. 6d. per ton.

The Committee recommends the approval of the draft contract with Messrs. E. Bennis & Co., Ltd., for chain grate stokers for three boilers at the Electricity Works.

York.—The Corporation has placed with Messrs. Siemens Bros. Dynamo Works, Ltd., its annual contract for carbon-filament lamps, radiator lamps, tantalum lamps and tantalum traction lamps.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Headquarters will be opened daily for the transaction of regimental business from 10 a.m. till 4 p.m., except Saturdays, on which days the opening will be from 10 a.m. till 12 noon. Headquarters will be closed for all purposes on August 3rd and 4th, 1914.

(Signed) F. R. HOLT-WHITE, Capt. R.E., Adjutant,
For Officer commanding L.E.E.

Improper Use of the Letters A.M.I.C.E.—At the Auckland (N.Z.) Police Court, John Rogers, engineer to the Mount Eden Borough Council, was charged with having publicly used in connection with his profession the letters A.M.I.C.E., whereas his name did not appear on the list of Associate Members of the Institution of Civil Engineers, having been removed in 1905. The defendant was fined £5 and costs.—*A.M.S.*

FORTHCOMING EVENTS.

Institution of Municipal Engineers.—Friday and Saturday, July 3rd and 4th. North-Western Districts meeting at Manchester.

Royal Institution of Great Britain.—Monday, July 6th. At 5 p.m. At Albemarle Street, W. General Meeting.

Institute of Naval Architects. Institution of Engineers and Shipbuilders in Scotland. North-East Coast Institution of Engineers and Shipbuilders.—July 7th to 10th. Joint Summer Meeting in Newcastle-upon-Tyne.

Salford Technical and Engineering Association.—Saturday, July 11th. Visit to Carborundum Co., Ltd., Trafford Park.

NOTES.

New Chairman of the B.E.A.M.A.—At a meeting of the Council of the British Electrical and Allied Manufacturers' Association, held at 36, Kingsway, W.C., on the 25th inst., Mr. F. R. Davenport, managing director of Messrs. Willans & Robinson, Ltd., was elected to the office of chairman of the Council, recently rendered vacant by the death of Mr. A Bruce Anderson.

The Williams Fire-Damp Indicator.—On Friday last a demonstration of a new fire-damp indicator or methanometer, the invention of Mr. Alfred Williams, was given at the Hotel Cecil. The apparatus was introduced by Prof. S. P. Thompson and Dr. Erskine Murray, while Mr. R. Smillie, M.P. (President of the Miners' Federation) and Mr. W. Brace, M.P., also testified to the need for and value of such an appliance.

The Williams indicator consists of a detector, containing a pair of differential thermo-electric junctions, coupled in series in the circuit of a sensitive galvanometer of the milli-voltmeter type, the needle of which moves over a graduated scale giving direct percentage readings of methane. Each thermal junction is embedded in a small bead of porous stoney material and one of the latter is impregnated with platinum black. In the presence of even a small percentage of methane, the impregnated terminal rises in temperature, due to the catalytic action on the platinum black, and a small thermo-electric current is generated, the extent of the latter being recorded on the indicating instrument. So long as the two thermal junctions remain at the same temperature their actions balance and no movement of the instrument occurs, so that local changes of temperature have no effect. To get over the insensitiveness of platinum black when cold, each of the small terminal beads is initially heated to the same extent by a minute platinum loop embedded in it, and in circuit with an auxiliary cell.

In the apparatus shown the detector head, protected by a metal cover and gauze, was fixed on a wooden handle and coupled by flexible to the indicating instrument, which with the cells was contained in a small portable box; the apparatus is, of course, in a preliminary stage, but owing to its electrical nature it is anticipated that an automatic continuous recorder on the surface, together with an audible warning of the danger point, would be a possible development, while portable sets in the hands of the firemen would render the inspection of crevices much more trustworthy than they can be with the ordinary safety lamp.

The Williams indicator in its present form cannot supersede the safety lamp in the hands of the worker in a fiery mine, as a personal safeguard, and the accuracy of its percentage readings—and the safety of those depending on them—appears from Prof. Thompson's report to rest entirely on the constancy of the heating current to the thermal couples *under all conditions*. A simple, practical means, suited to mining conditions, for obtaining this constant heating current, should undoubtedly have been demonstrated to the meeting as an essential part of the Williams apparatus; this feature is apparently lacking, although necessary to its successful use on a commercial scale.

The introduction of a reliable fire-damp indicator would hasten the more general use of miners' electric lamps and thus lead to improved illumination generally, lessening the numerous accidents attributable to poor lighting and the disease known as miners' nystagmus, due to the same cause.

A 1916 Exhibition.—The Machine Tool and Engineering Association, Ltd., which is organising the Second International Engineering and Machinery Exhibition to be held at Olympia in September and October, 1916, does not intend to let the trade remain in doubt as to the arrangements. Considerably more than two years and a quarter in advance of the event it has issued a very complete exhibitors' guide and plan of the Hall, so nobody can plead that he has not time to weigh the whole matter up long before the closing date for space applications. The regulations relating to construction of stands, electric wiring and dangerous exhibits, occupy a number of pages, and there are the necessary perforated forms for applications for space, electric light and power service, and so forth. Judging from the early publication of so full a guide, it is obviously the intention of the Association to secure a big success, and we recommend electrical firms who are interested in the matter to communicate with the secretary, Mr. H. G. Williams, at Queen Anne's Chambers, Tothill Street, Westminster, S.W., for copies of this publication.

Mr. A. E. Fellowes is the Exhibition manager, and Messrs. Albion T. Snell & Partners, are the consulting engineers.

Street Improvements Electric Railway Company's Liability.—On Friday, June 26th, the Judicial Committee of the Privy Council delivered judgment in an appeal by the British Columbia Electric Railway Co., Ltd., against an order of the Supreme Court of Canada. The respondents were the Vancouver, Victoria and Eastern Railway and Navigation Co. and others.

The appeal was argued before Lords Moulton, Parker and Sumner and Sir George Farwell in May, and the question was whether the Board of Railway Commissioners had jurisdiction to direct the British Columbia Electric Railway Co. to pay part of the costs of bridges over certain streets in Vancouver.

Mr. Upjohn, K.C., Mr. Bodwill, K.C., and Mr. W. Gordon-Brown (instructed by Messrs. Linklater, Addison and Brown) appeared in support of the appeal; Mr. A. H. MacNeill, K.C., instructed by Messrs. Blake and Redden, represented the Vancouver Railway, while the other respondents were represented by Sir R. Finlay, K.C., Mr. J. S. Hay and Mr. Arthur Page, instructed by Messrs. Laurence Jones & Co.

LORD MOULTON, in delivering the judgment of the Board, said that the British Electric Railway Co., referred to as the Tramway Co. in the pleadings, were a company operating street railways in the city of Vancouver under powers conferred upon them by an Act of the Legislature of that Province. Their railways were local street railways wholly situated within the Province of British Columbia, and had not been declared to be for the general advantage of Canada, or for the advantage of two or more provinces, so that they had not passed into the domain of the legislation of the Dominion Parliament. The respondent railways undertaking, on the other hand, had been declared to be worked for the general advantage of Canada. Part of its track through Vancouver city ran along the bottom of a valley, which was crossed by four streets. The Corporation, in order to avoid the trouble to traffic caused by these streets crossing the track, owing to the gradient, applied to the Railway Board for powers to construct viaducts, and the application was granted and the costs apportioned among the various respondents to the application. The appellants contended before the Supreme Court of Canada that there was no jurisdiction to order them to pay the cost of the erection of the viaducts or any portion, but by a majority the appeal was dismissed. They then appealed to the Privy Council.

Their LORDSHIPS could find nothing in Secs. 227 and 229 of the Railway Act which gave the Railway Board jurisdiction to deal with matters which were simply matters of street improvements. No doubt, as the Railway Board put it: "It being a substantial benefit to them (the tramway company), we are of opinion that they should contribute to the costs of the two bridges they will use—that is, the bridges at Hastings and Harris Streets," was a cogent reason for their decision. But the fundamental error the Board made was in thinking that this gave them jurisdiction to order appellants to pay the costs or a portion of it. There was nothing in the Railway Act which gave any such jurisdiction. It followed that they would humbly advise His Majesty that the appeal should be allowed, with costs.

Prof. Perry's Retirement: Proposed Presentation.—Prof. Perry, F.R.S., has recently retired from the staff of the Imperial College of Science and Technology, and we are informed that a fund is being raised for the purpose of giving expression to the appreciation of his services to the teaching of mathematics and to engineering education. An appeal for subscriptions has been issued to his former students and colleagues at the Imperial College and at Finsbury Technical College, but there are doubtless many others who have benefited by his published works, and who will desire to subscribe to the testimonial fund. It is to be hoped that there will be a ready response, which will allow the Committee to commemorate his work in a fitting manner. Past and present students of the Imperial College should also note that another fund is being raised for a testimonial to Prof. J. Harrison. Subscriptions should be sent to the Hon. Treasurer, P. T. Wrigley, Esq., M.A., Royal College of Science, South Kensington, S.W.

London Electric Railways Parliamentary Deposits.—On the application of the London Electric Railway Co. and the United Electric Railway Co., Mr. Justice Joyce, on Tuesday, directed payment out of Court of Parliamentary deposits. Mr. Austen Cartmell, who made the application, said that the deposit in question was paid in by the Edgware and Hampstead Railway Co., in respect of part of their undertakings in 1902, 1905 and 1907. In the years 1912 and 1913 there was an agreement with the London Electric Railways, by which the latter took over all the liabilities of the former together with the assets. Sec. 61 of the London Electric Railways Act, of 1913, provided for transfer of the Hampstead deposits to a total amount of £20,000. Mr. Justice Joyce directed payment out to the applicants as asked.

The Standardisation of Electrical Fittings on Petrol Motor-Cars.—The Electrical Equipment Committee Division of the Standards Committee of the American Society of Automobile Engineers has decided to recommend to the latter body at its forthcoming annual meeting that all insulating material used in connection with plugs, sockets and similar devices for use on petrol cars shall be capable of withstanding for 30 min. a temperature of 300° Fahr., and also that the single-wire system with earthed return be the recommended practice in connection with electrical fittings on motor-cars.

For Sale.—Salford Electricity Committee has for disposal three 170-KW D.C. motor-alternators, with switchgear. Particulars are given in our advertisement pages.

The British Association in Australia and Havre.—We have received particulars of the arrangements, as far as it has been possible to make them, for this year's meetings of the B.A. The list of papers, &c., is subject to revision and amplification. The Sections will meet at Melbourne on August 14th, 18th and 19th, and at Sydney on August 21st, 25th and 26th.

In Section A, the presidential address of Prof. F. T. Trouton will be read by Prof. A. W. Porter, and the following are among the subjects down for consideration:—

Joint meeting with Section B on "The Structure of Atoms and Molecules," opened by Sir E. Rutherford. Speakers: Prof. H. E. Armstrong, Prof. W. M. Hicks, Prof. Orme Masson, Prof. W. J. Pope and others.
Prof. E. Goldstein, "On Salts coloured by Cathode Rays."
Prof. T. R. Lyle, "Demonstration of a Mechanical Analogue of Wireless Telegraphic Circuits."
Prof. T. R. Lyle, "Demonstration of a Wave-tracer."
Sir E. Rutherford, "The Origin and Nature of the γ Rays from Radium."
Prof. O. W. Vonwiller, "Photo-electric Effect in Selenium."
H. Moseley, "High-frequency Spectra."
Prof. W. G. Duffield, "The Pressure upon the Poles of a Carbon Arc."
Joint discussion with Section G on "Wireless Telegraphy," opened by Sir O. J. Lodge.
Prof. J. A. Pollock, "Some Measurements of the Wave-length in air of Electrical Vibrations associated with a thin, straight terminated rod."

In the Engineering Section ("G") the following are included in the proceedings:—

SECTION G.—ENGINEERING.
MELBOURNE AND SYDNEY.

Presidential Address by Prof. E. G. Coker on "Stress Distribution in Materials" (to be delivered at Sydney).
Joint Discussion with Section A on "Wireless Telegraphy" (Sydney).
Mr. E. K. Scott, "Irrigation Dams and Hydro-Electric Power."
Mr. J. J. C. Bradfield, "Proposed Metropolitan Electric Railways."
Profs. E. G. Coker and L. N. G. Filon, "The Stress-Distribution in Short Compression Members."
Prof. E. G. Coker and Mr. W. A. Scoble, "Temperature Cycles in Heat-Engines."
Prof. W. E. Dalby, "Imperial College of Science and Technology; the New Engineering Laboratories of the City and Guilds of London Engineering College."
Prof. W. E. Dalby, "Railways and Motive Power."
Prof. W. E. Dalby, "The Testing of Materials."
Prof. G. W. O. Howe, "The Capacity of Radio-Telegraphic Aerials."
Dr. W. Rosenhain, "The Behaviour of Metals under Strain."
Dr. W. Rosenhain, "The Distribution of Phosphorus in Steel."
Prof. W. M. Thornton, "The Limiting Conditions for the Safe Use of Electricity in Coal Mining."
Prof. W. M. Thornton, "The Lost Pressure in Gaseous Explosions."
Reports of Committees on:—(*a*) "Gaseous Explosions" (*b*) "Stress Distributions in Engineering Materials."

A number of members of the Association left this country for Australia on June 22nd; others will leave on July 3rd.

The Havre meeting will be held from Monday, July 27th, to Sunday, August 2nd. A provisional programme has been issued, and full information of visits, discourses, &c., can be obtained from Dr. A. Loir, Comité Local de l'Association Française, Bureau d'Hygiène, Hotel de Ville, Le Havre.

The Liverpool Strike.—There are no prospects of an early settlement of the strike of electrical workers at Liverpool. The employers are apparently determined not to accede to the demands put forward on behalf of the men, and are content to adopt a waiting policy. There is a scarcity of big contract jobs at present. A printed statement has been issued, in which the men allege that attempts have been made to induce them to leave the Union by an offer of a penny an hour advance, which, it is stated, they refused. The officials of the Electrical Masters' Association deny that any such offer was made to the men. The policy that they have adopted meets with the unanimous approval of the members of the Association who are holding firmly together. The employers claim that several of the men on strike are dissatisfied with the policy of the Union.

Zero Resistivity.—In a communication to the French Academy of Sciences on Monday last, Prof. D'Arsonval described experiments made by Prof. Kamerlingh Onnes, of Leyden, who found that mercury cooled to a temperature of 4·19° absolute, tin to 3·8°, or lead to 6°, offered no resistance to the passage of an electric current. A bobbin wound with 1,000 turns of fine lead wire had a resistance at the ordinary temperature of 736 ohms, but when it was immersed in a bath of liquid helium the resistance became almost zero, and a current set up in the bobbin by induction persisted for several hours without perceptible diminution. It is suggested that the observation will open a new path of research into the continuity of matter.

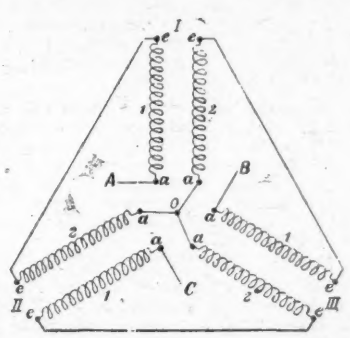
The daily Press treats the matter as a remarkable discovery; it is a remarkable experimental feat to demonstrate the fact, but the phenomenon has been predicted for half a century, being clearly indicated by the variation of resistance of metals with temperature.

Shock Claim in Canada.—Judgment for $1,200 and costs in favour of Arthur E. Rayner, a painter, of Niagara Falls, against the Toronto Power Co., Ltd., has been given at Osgoode Hall by Chief Justice Falconbridge. Rayner was painting a transmission line tower belonging to the company and had been assured that there were no live wires on it. While pulling his brush out of the paint pot, which was hanging on one of the supposed dead wires, he received an electric shock, which caused him to fall 7 or 8 ft. to a plank walk. A thumb, one finger, and several toes were burned off. He entered action through his mother, as he was not of age, to recover $10,000.

Wages in the Midlands.—We read in the *Times* that the Birmingham and District Engineering Employers' Federation have received notice from the Engineering and Allied Trades Federation for an increase in wages of 5s. a week for all employés over 23 years of age. The number of men concerned is about 40,000. At present men in the engineering trades over 23 years of age are receiving 38s. a week and the hours range from 48 to 53.

Alternator Connections Eliminating Triple-Frequency Harmonics.—Star-connected alternators, with earthed neutral point, frequently cause disturbance in neighbouring telephone systems, due to the presence of triple-frequency harmonics in the alternator pressure wave. During the time interval corresponding to the phase difference between the main alternator E.M.F.'s, there occur n complete periods of the $(3n)$th harmonics, which are thus in phase in all three generator phases. When the alternator supplies a cable network, it supplies single-phase triple-frequency currents to the condenser formed by the three cable cores and earth. In their passage through the earth, these vagabond currents cause more or less serious disturbance in neighbouring telephone circuits. Among the means which have been suggested to avoid such disturbance is the provision in the power cable of a metal sheathing, insulated from the cores and from earth, and connected to the neutral point of the alternator, to form a return path for the triple-frequency currents. Alternatively, the alternator neutral may be connected to an over-voltage safety device not earthing the neutral normally, but earthing it automatically in case of relatively small over-voltage. Yet another method is to damp out the dangerous harmonics by a current resonance circuit connected between the neutral point and earth, but the most rational procedure is to eliminate the offending harmonics from the voltage wave of the alternator.

With this end in view, R. J. Jensen (Copenhagen) has devised the zig-zag alternator connections shown in fig. 1, from the *Elektrotechnische Zeitschrift*. An even number of slots being used per pole per phase, each phase winding I, II, III, is



divided into equal parts 1, 2. The points $2a$ are connected to a neutral point 0; the points $2e$ are connected to the points $1e$ of the following phases; and A, B, C constitute the terminals of the machine. Thus arranged, the phase voltage equals the difference between the pressures III, I, &c., *i.e.*, it is $\sqrt{3} \times$ the pressure per half-phase, instead of $2 \times$ half-phase pressure, as in ordinary star-connected alternators. The length of armature bars must, therefore, be $2/\sqrt{3} = 1{\cdot}15$ times normal for a given terminal p.d. The end connections remain of normal length, hence the extra weight of copper is about 6 per cent.

In such an alternator pressure harmonics of triple frequencies are in phase in all windings taken from a to e in each phase but, each phase circuit comprising a 2 and a 1 coil connected in opposition, the triple-frequency harmonics are neutralised completely. The resultant armature reaction is of the same magnitude as in an ordinary alternator of equal output, but the ohmic and inductive pressure drops are each 6 per cent. and the iron loss 15 per cent. greater in the zig-zag wound machine.

Zig-zag connections have already been used in three-phase transformers to compensate for unbalanced loading. Such a transformer, with one ordinary and one zig-zag connected winding, blocks currents of triple frequency, hence its neutral point can be earthed without fear of causing telephone disturbances.

The Betulander Relay Automatic Telephone System.—In our issue of May 16th last year, it will be remembered, we published a description of the Betulander automatic telephone system, which had been taken up by the Marconi Co., and of which we had formed a very favourable opinion; in fact, it appeared to us that by confining the movements of the mechanical selectors to a straight-line motion, a new departure had been made which would probably "cut in two," as our American friends would say, the difficulties and expense of the automatic exchange. Since then our readers may have wondered why nothing more was heard of this remarkable new system—certainly we have done so—but now we understand, and fully appreciate the reasons which have held it in abeyance. By the courtesy of Mr. C. B. Clay, manager of the Betulander Automatic Telephone Co., Ltd., we were on Tuesday last enabled to inspect a still newer system, devised by Messrs. Betulander and Palmgren, which was brought out before the former system had fairly got under way, and which upsets all preconceived ideas about automatic telephony. It was the development of this system which led the owners of the rights in the Betulander patents (outside Sweden) to hold their hand, and there can be no doubt as to their wisdom.

In the new system there are no travelling switches at all; the whole of the complicated operations involved in finding free junctions, selecting lines, and completing the connections, besides providing the necessary automatic guards, giving busy signals, calling subscribers, cutting off, &c., are accomplished entirely with relays of the simplest type—relays such as are working in hundreds of thousands in our manual exchanges, where their reliability has been proved to demonstration. We should hardly have thought it possible; but we have seen the apparatus at work, and working with precision and celerity; we have timed calls for such a number as 9999, involving the maximum number of relay operations in a four-figure exchange, and got through repeatedly in less than four seconds from the moment of lifting the receiver (after setting the number levers) to the moment when the bell began to ring. The operation of the apparatus is invisible, except for the flickering of signal lamps which show the passage of the call through the various banks of relays, while the clicking of the latter sounds, say, like a rapidly-operated typewriter.

The performance was unique in our experience, and the system a marvel of mechanical and electrical ingenuity. It is impossible to enter into details in the present issue, but next week we hope to publish a description of the principal features of what, we are not afraid to say, constitutes an epoch-making advance in automatic telephony.

Electrical Accidents in German Mines.—The annual report of the *Zeitschrift für Berg-Hutten und Salinenwesen* presents interesting data concerning electrical accidents in Prussian mines during 1912. A striking feature is the number of casualties which can only be classified as easily preventable. The number of accidents scheduled was 69 (including 7 carried forward from 1911); of these 40 were fatal, and the remainder involved more or less serious burns. From an analytical table in the original report the following summary is prepared:—

	Above ground.	In-by.	Total, including unclassified.
Fatal.—Due to low-pressure current (127-250 volts)	3	14	17
Due to high-pressure current ...	16	5	23
Not fatal.—Due to low-pressure current (220-250 volts)	4	4	8
Due to high-pressure current ...	12	3	21
Total	38	28	69

The large number of fatal accidents in-by due to low-pressure current should especially be noted; there is no doubt that under the humid conditions prevailing in-by, even 100 volts may be dangerous to life. Three-phase current is used very extensively in mining work; indeed, direct current is practically confined to main-shaft winding motors, haulage locomotives and arc lamps.

An analysis of the circumstances attending the accidents reported shows that the matters requiring attention most urgently are reduction of risk to men engaged on repairs or alterations; improved design of motor control switchgear; and safer arrangement of locomotive supply circuits. Verbal warnings and instructions are easily misunderstood or forgotten, and danger signs of whatever type soon lose their appeal. The only safe practice appears to be complete enclosure or isolation of all live parts and the provision of such electrical or mechanical interlocking devices as will ensure that any conductor is made dead before it is made accessible. The importance of employing only experienced and reliable men in electrical work in mines cannot be overrated.

No fewer than 11 cases of serious burning were (in 1912) due to arcs penetrating through switch covers. Standard enclosed switchgear, as used in mining work in this country, could not give rise to such accidents as the above; and now the German rules prohibit open slots in all cases.

In seven cases the primary cause of violent arcing was neglect to return the starter of slip-ring induction motors to the off position, or neglect to open the rotor short-circuiting device or lower the brushes before starting up. Suitable interlocking or automatic gear is the obvious remedy for this risk.

Of nine accidents caused by touching haulage loco. trolley wires in-by, seven were fatal, though in five fatal accidents the line voltage was only 220-250 volts.

Institution Notes.—ASSOCIATION OF CONSULTING ENGINEERS (INCORPORATED).—The report of the Committee for the 16 months ended April 30th, 1914, submitted to the second ordinary general meeting of the Association on May 25th, has just reached us. It states that the number of members at June 1st, 1914, was 70. On November 13th, 1913, a certificate of incorporation was signed by the Board of Trade, after due inquiry, and on December 1st, at the first meeting of the Committee of the Incorporated Association, Mr. A. H. Dykes and Mr. S. R. Lowcock were elected as hon. secretary and hon. treasurer respectively, Mr. G. M. Taylor being appointed chairman of the Committee. The first general meeting was held on February 2nd, 1914, and confirmed the acts of the Committee. At an extraordinary general meeting on July 20th, 1913, membership of the Institution of Civil Engineers of Ireland was accepted as sufficient qualification for membership of the Association. In November last the Committee took action in respect of the electrical department of a certain County Borough, which offered the services of its officers to mill owners as consulting engineers at a fee of 5 per cent., offering also to purchase plant for its clients on better terms than the latter could obtain. The Committee considered this practice unfair and detrimental to the public interest, and believes that the authority in question has discontinued it. On February 2nd the inaugural dinner of the Association was held at the Whitehall Club. An International Congress of Associations of Consulting Engineers was held at

Ghent in July last, and it was proposed that an International Association of Consulting Engineers should be formed, but the Committee has postponed the question of joining it until the Association has consolidated its position in this country. A system of classification of members has been adopted, so that anyone requiring the services of a consulting engineer can see from the list of members the class of work in which any individual member chiefly specialises. The Committee commends to the members a suggestion of one of them, that in drafting arbitration clauses in agreements, the choice of an umpire should be left to the Committee.

Institution of Electrical Engineers.—On Thursday last week the annual Conversazione of the Institution was held at the Natural History Museum, South Kensington; the guests were received by Mr. W. Duddell, President, and Mrs. John Smithers, and members of the Council. Music was provided by the String Band of the Royal Engineers, and by the Royal Windsor Glee Singers, and a pleasant evening was spent by the members and their friends, though the attendance appeared to be much smaller than in former years.

Amongst those present were Sir F. A. Bosanquet, Col. R. E. B. Crompton, Sir William Crookes, Sir J. M. Davidson, Col. R. C. Hellard, Col. Sir T. H. Holdich, Vice-Admiral Sir H. B. Jackson, Major J. N. C. Kennedy, Major-Gen. Beresford Lovett, Lt.-Col. the Hon. Sir N. J. Moore, Sir Henry Norman, Dr. F. G. Ogilvie, Major W. A. J. O'Meara, C.M.G., Baron de Ropp, Major-Gen. R. M. Ruck, and Sir John Snell.

Hard X-Rays as a Substitute for Radium Rays.—Attempts have been made for some time to replace the expensive radium and mesothorium products by the use of X-ray bulbs, recent experience having shown the excellent results to be obtained with hard and homogeneous Röntgen-rays.

In a recent memoir,* F. Dessauer, of Frankfort-on-Main, gives an interesting account of his own work in this connection. The therapeutic effects of X-rays are due to differences in sensitiveness of the various kinds of cells composing our tissues, soft rays being in this connection comparable to a heavy hammer, whereas the harder, more penetrating radiations may be likened to a delicate scalpel. While the hammer is in itself more efficacious, it obviously risks destroying the sound, as well as the morbid tissues; the scalpel, on the other hand, allows the latter to be cut out carefully. With regard to the violent action of soft rays, any differences in sensitiveness exhibited by the cells become negligible, the more so as this action cannot well be accurately localised. Whereas hard rays will act uniformly on limited regions, soft rays will attack the upper tissue layers with enormous violence, thus becoming unable to act on those lying beneath. Hard rays afford a means of producing the dose just required over a wide range, without any risk of destruction to sound tissues, while in the case of soft radiations the available limits of useful effects are rather narrow.

It has become possible to generate X-rays which, in part at least, are of a hardness approaching that of gamma rays, comparative tests having shown their hardness to be as high as one-quarter to one-third of that of the latter. While the greater part of the initial radiation has, in this case, been absorbed by filtration, the remainder is still much stronger than the rays of even the strongest radium product. It may thus be hoped that whenever morbid tissues can be irradiated from outside, radium may be replaced completely by X-rays.

As regards the treatment of internal cavaties, which could hitherto be effected only with radium rays, Dessauer, in conjunction with Sellheim and Meyer, has devised an X-ray bulb working in the interior of the body, and which, at the same time, provides for an efficacious filtration of the rays. The cathode of this bulb projects its rays, not on an inclined platinum disk, but into the interior of a metal cone, the inside of which is coated with platinum. The cathode is so designed that the focus does not form a point, thus spreading the cathode rays on the whole inside surface of the cone. Part of the X-rays thus produced will enter the interior of the bulb, this part being left unused. Another part issues through the metal wall, while undergoing a filtration which allows only the hard rays to pass. This metal cone, surrounded by a water cooler, is introduced into the cavities to be treated.

Messrs. Veifa-Werke, of Frankfurt-on-Main, on a system devised by Mr. Amrhein, have recently constructed an X-ray bulb which, in a minimum of time, allows quite unprecedented amounts of hard X-rays (up to ten times more than with ordinary bulbs) to be generated and projected into the tissues of the body. This remarkable result is mainly due to the adoption of a new cooling principle, based on the utilisation of the heat of vaporisation. Water is drawn in from a vessel and pulverised so as to produce a spray as fine as possible, which, by means of the air current, is thrown with extreme violence against the rear wall of the hollow anti-cathode. The amount of heat thus carried away is enormous; the bulb may be charged very strongly without any appreciable heating of the anti-cathode.

Fatalities.—A correspondent writes: "Joseph Roddy, of Leighton Lane, Leeds, a linesman in the employ of the Post Office, fell from a 45-ft. telegraph pole whilst working on the Wakefield Road at Lofthouse on Monday afternoon. He was taken to the Leeds Infirmary, where he died. He was engaged in taking measurements of the wires at the time, and it is believed he had got a severe shock through accidental conduct through some power wires. He was seen to fall by a little girl, who noticed a big flash at the moment he fell. He had sustained extensive burns"

* *Die Umschau*, No. 17, 1914.

Educational Notes.—The "School of Oriental Studies" is the outcome of a movement towards the provision of facilities for the study of Oriental languages in London, which are at present very restricted; the site and buildings of the London Institution, Finsbury Circus, have been secured for the purpose by Act of Parliament, and are about to be adapted and extended, and about half the annual expenditure (£14,000) will be provided by the British Government, the Government of India, and the London County Council. An appeal is being made for the balance, and it is stated that an endowment fund of not less than £100,000 should be raised. The British Empire embraces a population of nearly 400 millions of Eastern peoples, and is closely related with as many more, while our Eastern and African imports and exports amount to more than £210,000,000 per annum. The necessity of such a school is therefore manifest. It will be attached to the University of London. Donations should be sent to Sir Montagu Turner, 38, Bishopsgate, E.C.

Copper in Russia.—Practically the whole copper industry of Russia is controlled by a single large company, the "Medj," and out of the total production of copper in 1912, 93·8 per cent. was produced by this company, and other concerns working in connection with it. In 1913 this percentage had risen to 95·7 per cent., and there were thus only 7·3 per cent. produced by "outsiders." The total output of copper amounted in 1913 to 32,784 tons, as compared with 33,000 tons in 1912, and 25,024 tons in 1911, of which the bulk was raised in the Ural district, which was responsible for 52·5, 50·2 and 47·4 per cent. of the above-mentioned three years' production. Next to the Ural comes the Caucasian district, where 30·2 per cent. of the total production was raised in 1913. The third copper-producing district is Siberia, with a percentage of 16·9 per cent. for 1913. The output of copper from the chemical works amounted to 4·2 per cent. of the total production. For the present year this is estimated to be raised considerably, viz. to 39,520 tons.

Voting by Electricity.—A time-saving electric vote-recording arrangement is about to be installed in the American House of Representatives in Washington, at an estimated cost of £4,000. There are at present 435 members of the House, the recording of whose votes on a division is stated to occupy 45 minutes. By means of the projected electrical device, it is expected that it will be possible to record the voting on a division in from five to ten minutes.

Veritas Sports.—The sixth annual sports of the Veritas Athletic and Social Club (Messrs. Falk, Stadelmann & Co., Ltd.) are to take place to-morrow, Saturday, at the "King's Oak" track, High Beech, commencing at 11 a.m. Mr. F. S. Prior is again acting as hon. secretary.

Appointments Vacant.—L.C.C.—Whole-time electrical engineering mechanic at Hackney Institute, Dalston, N.E. (42s.); shift engineer, for Lancashire Electric Power Co.; mains and assistant electrical engineer (£104 +), for Londonderry Corporation; instructor of telegraphy and telephony (12s. 6d. per evening), for East Ham Technical College evening classes; superintendent of meter and electrical testing department (£150), Salford Electricity Works; assistant electrical engineer (£140), for Redditch U.D.C. Particulars are given in our advertisement pages.

Efficiency Investigations on the Half-Watt Lamp.—Photometric, spectrophotometric and bolometric investigations carried out by Dr. Lux, and described in the *E.T.Z.*, indicate that though the half-watt tungsten lamp offers great advantages over the ordinary tungten lamp, it does not represent a radical advance in the efficiency of light production. Using Wien's equation, the author concludes that the filament temperature of a 1,000-c.p., 110-volt "Nitra" half-watt lamp is 2,850° C. absolute, as compared with 2,450° C. absolute, the filament temperature of a 200-c.p., 110-volt Osram lamp.

In respect of spherical candle-power per watt the ordinary tungsten lamp is superior to the half-watt type; at 2,400° C., for instance, the former yields 0·76 spherical hefner per watt and the latter only 0·64 spherical hefner per watt, *i.e.*, 18·75 per cent. less light for a given power input. Thanks to its nitrogen filling, the half-watt lamp reaches an efficiency which is high, but lower than that obtainable were it possible to run the filament of an evacuated lamp at the same temperature. Winding a 0·5-mm. wire to form a 2-mm. spiral reduces the heat loss due to convection from 6 per cent. to 1 per cent., but about 17 per cent. of the total light is lost inside the closely wound spiral. Comparative radiation data for half-watt and ordinary tungsten lamps are as follows:—

	Input watts.	Total radiation watts.	Luminous ÷ total radiation.	Luminous radiation ÷ input.	Heat radiated per 100 hefner watts.
Half-watt lamp.	237	155	2·01%	1·32%	133
	265	171	3·19	2·06	93
	392	242	5·02	3·11	49
	525	316	8·04	4·82	32
Ordinary tungsten.	95	83	3·76	3·32	125
	102	90	4·41	3·70	103

Under normal full-load conditions in the half-watt lamp, some 8 per cent. of the total radiated energy, but only 4·8 per cent. of the energy supplied, is available as light, the discrepancy being due to the considerable loss of energy by conduction and the loss of light within the tightly wound spiral itself. Loss by conduction is considerably greater than in evacuated lamps. No considerable further improvement can be anticipated in the efficiency of tungsten lamps, the efficiency being 0·3 watt per spherical hefner when the filament temperature reaches the melting point (3,200° C. absolute) of tungsten.

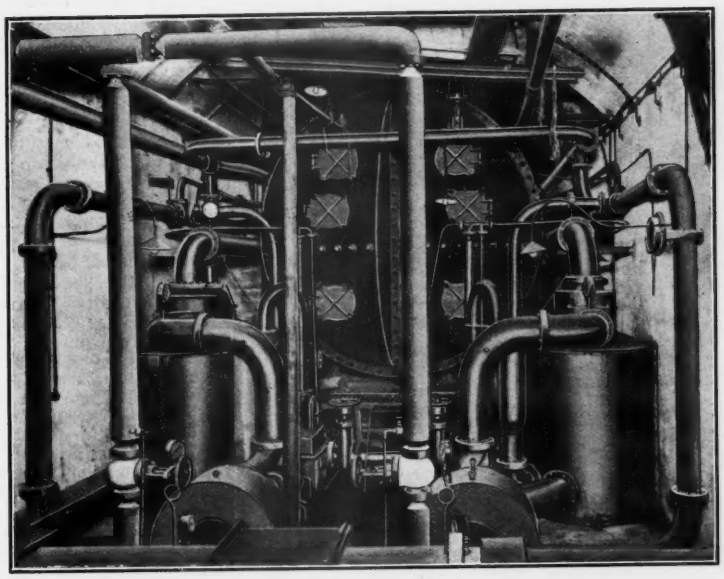
THE MANCHESTER 15,000-KW. TURBINE SET.

ONE of the most interesting turbine plants, and the largest so far installed in this country, has just been started up at the Stuart Street generating station of the Manchester Corporation electricity department.

This is a Howden-Siemens unit, with a normal output of 15,000 KW., and an overload rating of 19,000 KW. The speed is 1,000 R.P.M. The turbine is of the Zoelly impulse type with 14 wheels; the largest overall diameter is roughly 9 ft., and the smallest 8 ft.

The turbine runs on steam at 190 lb. pressure and 600° F. temperature; and exhausts into a vacuum of 27½ in.

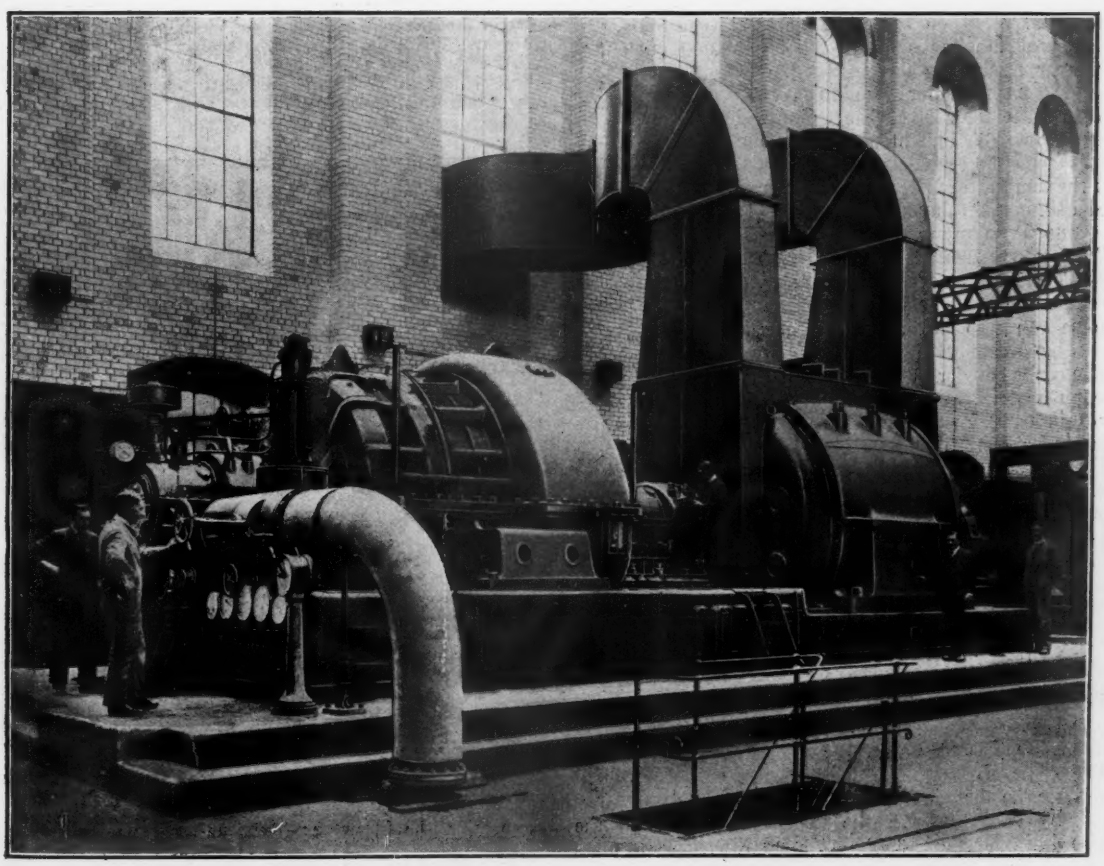
The condensing plant is of the surface type, by Messrs. Richardsons, Westgarth & Co. The condenser itself is cylindrical in shape, 11 ft. in diameter, and 16 ft. long between tube plates, and is built up of ¾-in. mild steel plates. It contains 6,550 ⅞-in. diameter tubes, giving a total cooling surface of 24,000 sq. ft. Following recent practice at Manchester, no main exhaust valve is installed between the turbine and condenser, but arrangements have been made for flooding the steam space of the condenser when the set is exhausting to atmosphere.



CONDENSER PLANT, 15,000-KW. TURBINE SET, MANCHESTER.

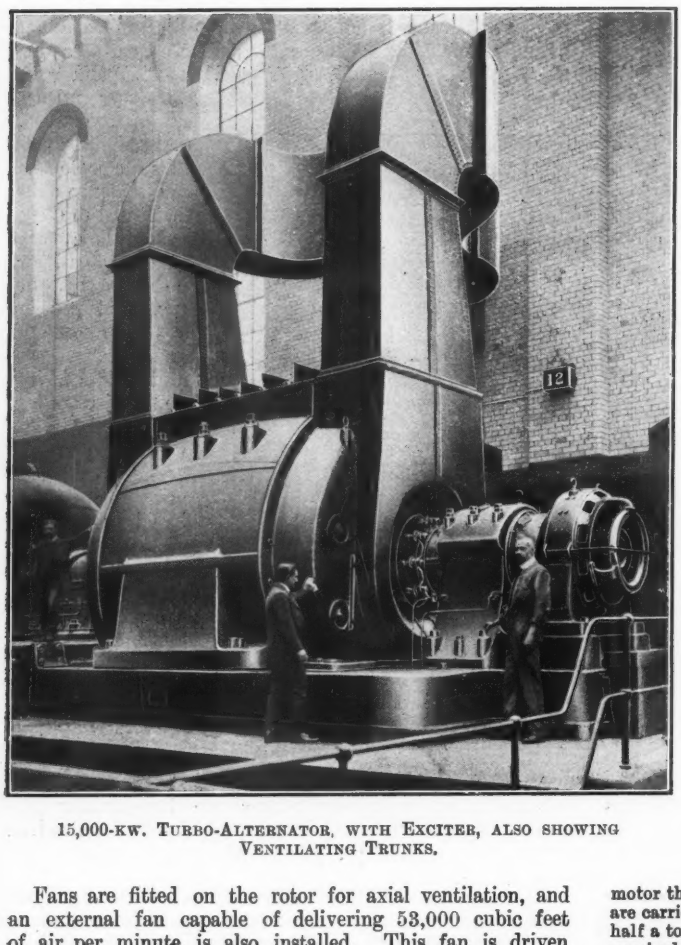
The air and water extracting pumps are of the kinetic type supplied by the Pulsometer Co., and consist of two units, each equal to 60 per cent. of the capacity of the plant, and each driven by a 100-H.P. impulse turbine at 3,000 R.P.M.; the turbine exhausts are utilised in the kinetic air ejectors and direct-contact feed-water heaters.

The same arrangement has been followed in the case of the circulating water pumps, which are also divided into two units, each equal to 60 per cent. of the capacity of the plant. Each unit consists of a Rateau multi-cellular centrifugal pump coupled to a 600-B.H.P. impulse turbine running at 3,000 R.P.M. These turbines exhaust into the main condenser; all the auxiliary turbines were made by Messrs. Richardsons, Westgarth & Co., Ltd.



VIEW OF 15,000-KW. HOWDEN-SIEMENS TURBO-ALTERNATOR AT STUART STREET GENERATING STATION, MANCHESTER.

The alternator, which is rigidly coupled to the turbine, is a three-phase machine generating at 6,600 volts pressure and 50 cycles; the stator is totally enclosed and bar wound with one mica insulated bar per slot.



15,000-KW. TURBO-ALTERNATOR, WITH EXCITER, ALSO SHOWING VENTILATING TRUNKS.

Fans are fitted on the rotor for axial ventilation, and an external fan capable of delivering 53,000 cubic feet of air per minute is also installed. This fan is driven by a 120-B.H.P. motor running at 670 revolutions per minute. The rotor is of the cylindrical type, about 67 in. in diameter, and weighs some 53 tons. It was stipulated that the temperature rise in the alternator after a six hours' full load run should not exceed 60° F. on any part of the machine.

Energy for excitation is provided by a 220-volt shunt-wound dynamo coupled to the end of the main shaft; current for this purpose can also be supplied from the station bus-bars.

The cooling air for the machine is passed through a Sturtevant wet-air filter, which works in parallel with the original installation of dry cloth air filters.

The guaranteed steam consumptions per unit, with steam at 190 lb. pressure and at a total temperature of 530° F., with a 27½-in. vacuum, and power factor of ·95, are as follows:—

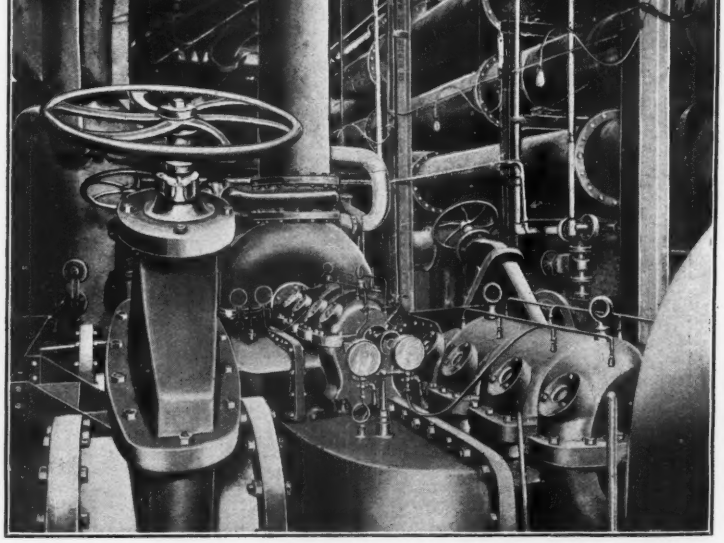
¼ load	16·95 lb.
½ „	14·92 lb.
¾ „	14·12 lb.
Full „	13·65 lb.
1¼ „	14·25 lb.

The Stuart Street plant works in conjunction with cooling towers and high vacuums are not obtainable.

The addition of this machine to Stuart Street station has increased its output capacity to 55,500 KW.; the maximum demand on the station last year was 36,120 KW., and the output in units generated 123,388,190.

The station is practically full up, but arrangements have been made up for replacing one of the original 1,500-KW. Yates & Thom-A.E.G. vertical slow-speed sets by a 6,000-KW. turbo-alternator running at 3,000 R.P.M., and this represents the utmost extension possible of the present station. The Manchester electricity undertaking continues to expand at an increasing rate. Last year 154,760,000 units were generated at all the stations, and nearly 118,000,000 units were sold, these figures comparing with 136,820,000 and 104,347,000 units approximately in the previous year. As the output for traction and public lighting remained nearly stationary over the two years, the increased total output may be traced to the power consumers. We are indebted to Mr. S. L. Pearce, the chief electrical engineer, for the information which we are able to give in regard to the new plant.

The Largest Cable-Making Machine in in the World.—MESSRS. JOHNSON & PHILLIPS, LTD., of Charlton, Kent, have just finished a cable-armouring machine for a cable factory in Vienna, which is of record size, because it will armour cables up to 6 in. in diameter, weighs over 70 tons, and is about 160 ft. long. The main shaft, which is hollow, is 13 in. in diameter, and carries six cast-iron disk wheels 12 ft. in diameter, each weighing 2½ tons. The general design follows the usual pattern as made for many years by Messrs. Johnson & Phillips, but, of course, there are many up-to-date improvements in detail. For example, the disks run on roller bearings; the end of the main shaft is fitted with a special swivelling thrust washer to take the pull of the armouring wires, which may amount to as much as 12 tons; and two of the disks are fitted with brake straps, which work iron to iron. The take-up stand will accommodate a drum of cable weighing 20 tons, and this also is a record in the way of size. The draw-drum is of the grooved type, 8½ ft. in diameter, and has four grooves, each 7 in. wide. The cable goes over one groove, then over a flat drum, over the next groove, and so on. The nominal speed of the machine is 12 to 16 R.P.M., and it is driven by a 75-H.P. two-phase motor through steel gearing having machined teeth. The bobbins are carried in forged mild steel frames, and each bobbin will carry half a ton of steel wire. The machine has the special attachments required for laying lock-coil armouring, and is also adapted for sheathing with steel tapes. It can be arranged for serving and armouring the following:—Compound, paper tapes, jute, compound, 48 wires or two steel tapes, compound, jute, jute, compound thick whiting and thin whiting.



TURBINE-DRIVEN CIRCULATING PUMPS, STUART STREET STATION, MANCHESTER.

THE BERLIN ELEVATED AND UNDERGROUND RAILWAY.

[BY OUR BERLIN CORRESPONDENT.]

The electrical energy for operating the Berlin Elevated and Underground Railway is generated in two power stations, partly as continuous and partly as three-phase current; the former is supplied directly to the feeding points of the contact rail, whereas the three-phase current feeds two sub-stations for conversion into direct current.

The Trebbiner-Strasse power house contains two 1,100-KW. and two 800-KW. compound engine sets, with Siemens-Schuckert D.C. 780-volt generators; also eight water-tube boilers, constructed for 165 lb. pressure, and fitted with superheaters.

The alternating plant includes four Siemens-Schuckert turbo-generators, each of 1,200 KW. capacity (at 780 volts and 1,000 R.P.M.), driven by two 3,600-H.P. Zoelly steam turbines; these are supplied with steam by eight water-tube boilers, with a steam pressure of 210 lb. (absol.) and a steam temperature of 350° C. in the superheaters.

Preheaters and economisers have been provided, and a mechanical coaling plant conveys the coal from barges in the Spree Canal and railway wagons into the boiler house.

The power house contains a buffer battery of the Tudor type, with a capacity of 1,470 ampere-hours, which works with a reversible booster on the Pirani system.

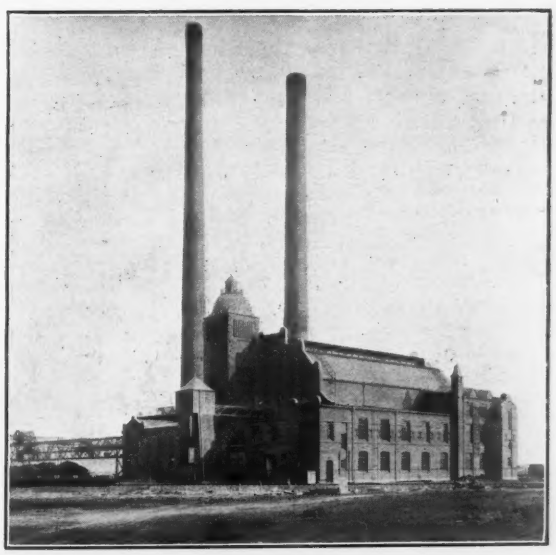
The Unterspree power house contains three Siemens-Schuckert three-phase turbo-generators, each of 4,000 K.V.A. output, at 2,650 volts and 40 cycles; these are driven by Zoelly turbines, and the generator pressure is stepped up to 10,000 volts.

Seven water-tube boilers supply steam at 240 lb. pressure, superheated to 375° C.

The boiler feed is passed through economisers. A coaling plant comprising a grab, slewing crane, travelling bridge, electric telpher and conveyor, has been provided to transfer the coal from Spree barges to the storage ground or boiler house.

The Bismarckstrasse sub-station comprises four Siemens-Schuckert rotary converters, each rated at 730 KW., at 480 R.P.M., and transformers for converting 10,000-volt three-phase current into 780-volt continuous current, also a buffer battery of 888 ampere-hours capacity, at one hour's discharge, with a reversible booster on the Pirani system. Another booster has been provided to serve as a standby.

The Senefelderplatz sub-station contains three cascade converters each of 1,500 KW. output at 300 R.P.M., for converting three-phase current at 9,600 volts pressure into continuous current at 780 volts, and one buffer battery of 1,850 ampere-hours capacity, at one hour's discharge, working in series with a reversible booster. Another booster of the same kind serves as a standby.



THE UNTERSPREE POWER STATION, BERLIN ELEVATED AND UNDERGROUND RAILWAY.

The power houses are connected with one another and with the sub-stations by armoured triple cables, which are mostly laid directly on the permanent way. Excess voltage cut-outs are inserted in the cables at given intervals.

As regards the feeder system, the various lines are divided into feeding districts; the east lines of the Elevated and Underground Railway comprise three, the West lines six, and the City lines five feeding districts.

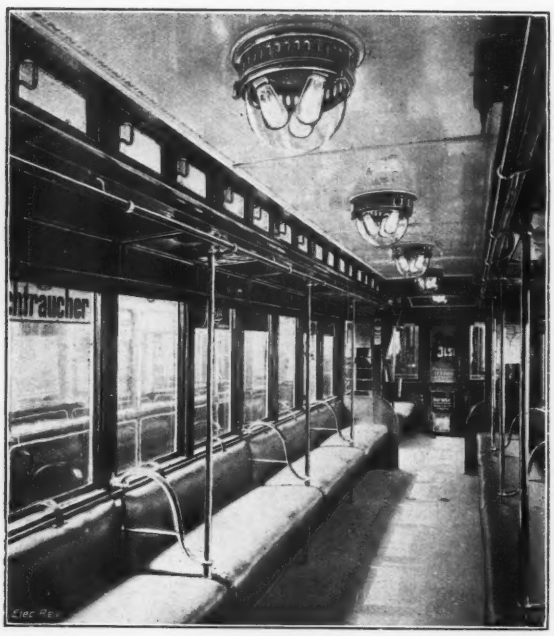
Insulated feeder cables of from 1,500 to 3,500 sq. mm. cross-section, have been provided to connect the power houses or sub-stations with each of the feeding districts—1,000 or 500 sq. mm. cables being used.

The 780-volt direct current is supplied to the cars by an insulated and laminated soft iron rail, about 3,600 sq. mm. in cross-section, arranged alongside the track.

The contact rails on the lines passing through tunnels are situated at a higher level than on the other lines, thus inserting at the same time the electric lighting circuit, as soon as the trains enter the tunnel.

SIX-CAR ELECTRIC TRAIN ON THE BERLIN ELEVATED RAILWAY

Current returns through the running rails, which are, of course, bonded and supplemented where required by bare copper cables laid beside the rails and connected to the



INTERIOR OF SECOND-CLASS CAR, BERLIN ELEVATED RAILWAY.

latter every 50 m. Cable cross-sections of up to 4,000 sq. mm. are laid out in the neighbourhood of the power houses and sub-stations, reducing to 1,000 or 500 sq. mm.

Trains are made up of from 2 to 6 cars, with 1, 2 or 3 motor-cars respectively; the provision of 8-car trains is being considered.

The motor-cars are third-class, or mixed second and third-class cars, and the trailers second-class, or second and third-class cars; they each have a capacity of about 100 passengers, of whom one-third find seating accommodation. Each motor-car empty, with its four motors, weighs about 24 tons, and each trailer about 15·5 tons.

The motor-cars are generally provided with a driver's cab, but some have two and others none at all; they are equipped with four 70-75-H.P. motors, but on the two-car trains running between Bismarckstrasse and Reichskanzler-platz only two motors of the same output are fitted. This allows a maximum travelling speed of 50 km. an hour to be reached; the average speed on the various lines is 25-30 km. an hour.

The signalling is arranged with block sections on the Siemens & Halske four-field system, individual sections reaching from one station to the other and being calculated for 2½ minutes headway, at an average speed of 27 km. an hour.

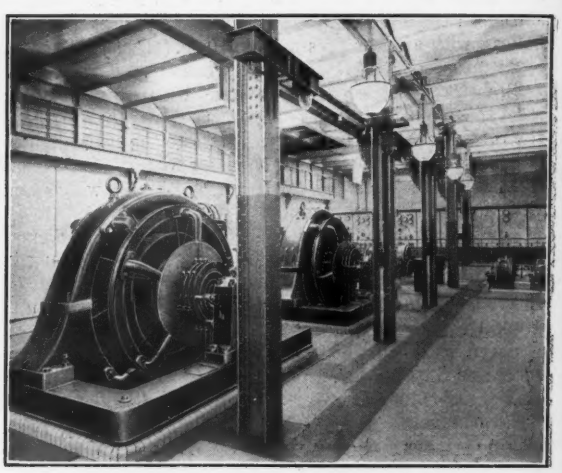
All stations are equipped with home and starting signals. Optical signals actuated from the stations are used exclusively, those in tunnels being light signals and those on the Elevated Railway sections semaphore signals, rendered visible in the dark by multicoloured lights. Any irregularities in the adjustment of points or the signals are signalled automatically.

The block instruments at the stations are interconnected, and when operated for a train to pass, the following one is locked until a rail contact situated at a train's length behind the starting signal has been passed through. Automatic train locking has been provided on the Spittelmarkt-Schönhauser Allee line, and is expected to allow of running at even shorter train intervals.

Electric clocks connected up to the master clock in Köthener Strasse and actuated and regulated every ½ minute are installed in all stations and offices, and complete inter-telephonic communication is provided.

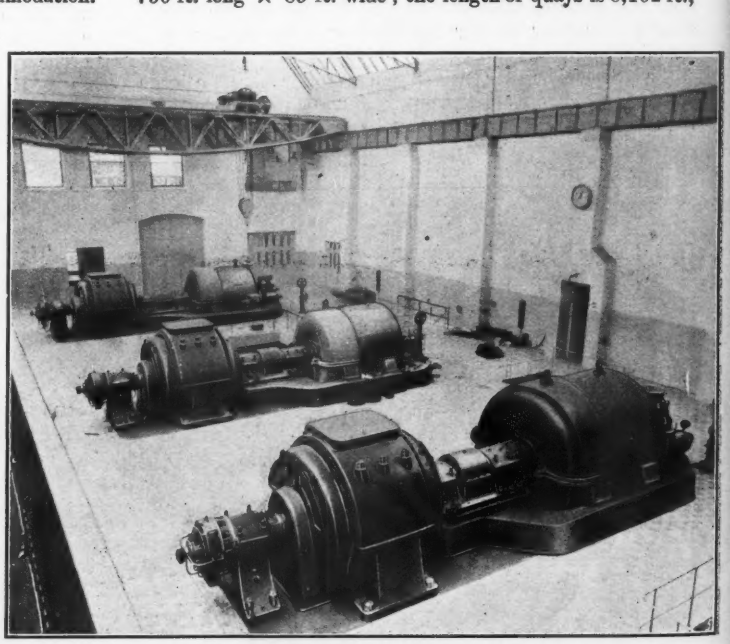
THE NEW DOCK AT HULL.

ON Friday last, by the courtesy of the Hull Joint Dock Committee, we were present at the opening, by the King, of the new dock which has been built by the North-Eastern Railway Co., in conjunction with the Hull and Barnsley Railway Co., to cope with the constantly increasing trade of Hull, the third port of the United Kingdom. The dock is the largest on the North-East coast, having a water



UNDERGROUND SUB-STATION, BERLIN RAILWAYS.

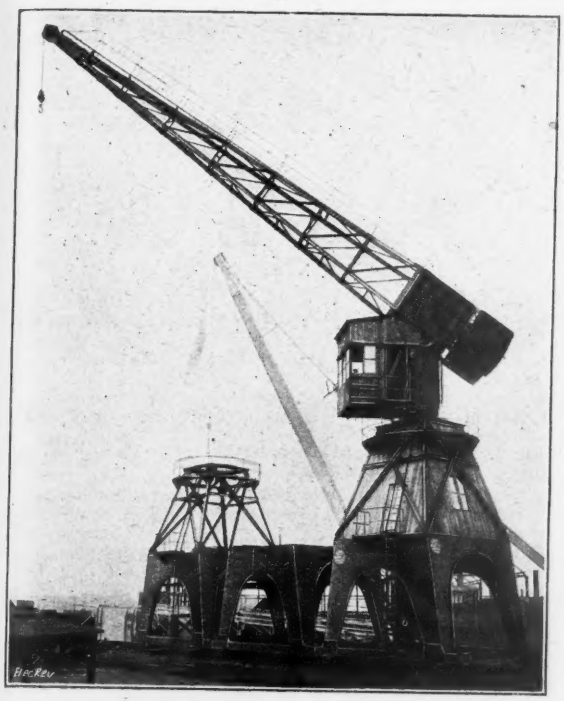
area of 53 acres, which can be extended to 85 acres; and the main basin measures 1,050 × 1,000 ft., so that the largest vessels can be turned in it. The entrance lock is 750 ft. long × 85 ft. wide; the length of quays is 8,162 ft.,



TURBO-GENERATING PLANT AT THE UNTERSPREE RAILWAY POWER STATION, BERLIN.

and there are to be two graving docks, coaling appliances, 53 cranes, huge warehouses and a grain silo. The equipment is at present incomplete, the grain silo and many of the

cranes, conveyers, &c., not having been erected yet, so it is not possible to enter upon details with advantage at present; but we may state that the whole of the power used on the dock will be provided through a 4,000-KW. sub-station at 440 volts D.C. by the Corporation of Hull, for which Mr.



TRAVELLING PORTAL CRANE BY MESSRS. ROYCE, LTD.

Herbert Bell is chief electrical engineer, and as the first "all-electric" dock in the kingdom it is of exceptional interest to our readers.

The commanding situation occupied by the port, which has railway access to about 400 collieries and annually ships 7,000,000 tons of coal, and is close to an industrial area inhabited by 11 million people, has enabled it to grow in size and importance to an extent not generally realised, so that it now challenges even London and Liverpool, and is gradually drawing traffic which has hitherto used those ports. While the new dock will very greatly extend the facilities for dealing with traffic, it should not be overlooked that the 10 previously existing docks at Hull are of great extent, amounting in the aggregate to more than 158 acres, in addition to two riverside quays, with over 100 cranes and 34 coaling appliances, and 51 warehouses.

The new Joint Dock will be provided with five electric belt coal conveyers, as well as one fixed and one movable hoist occupying the same berth; these will serve six berths arranged in echelon, so that each ship, of the largest class, can be loaded and moved without interfering with its neighbours, and the total coaling capacity will be 5,000 tons per hour. Of the 53 cranes, one will be an 80-ton floating crane, 43 will be movable electric cranes of three to 10 tons capacity, and nine will be 1½-ton cranes travelling on the roofs of the warehouses. The grain silo, which will have a capacity of 40,000 tons, and four discharging berths, will be equipped with eight underground electric belt conveyers, six portable elevators with weighers, and other modern appliances for handling grain.

We give an illustration of the north side of No. 3 Quay, showing the ferro-concrete warehouses, and on the left hand some of the quay cranes. Another view shows one of the latter complete; and some of the travelling cranes on the roofs of the warehouse appear in the former view. All the cranes have luffing jibs giving a horizontal movement to the load when luffing. The coal tips and the lock gates are operated by hydraulic power, but this is produced by electrically-driven pumps.

The whole of the work has been carried out under the direct supervision of the engineers of the two railway companies—Mr. T. M. Newell and Mr. R. Pawley. Mr. W. Ebdon acted as resident engineer, and Mr. T. L. Norfolk superintended the construction of the equipment. The general contractors for the dock were Messrs. S. Pearson and Son, Ltd., of Westminster; the contractors who supplied the electrical equipment are named below:—

Royce, Ltd.	Electric cranes.
Sir W. G. Armstrong, Whitworth & Co, Ltd.	Electric capstans and coal hoists.
Craven Bros, Ltd.	Electric cranes.
W. H. Allen, Son & Co., Ltd.	Centrifugal pumping plant.
Henry Simon, Ltd.	Grain-handling plant.
Head, Wrightson & Co., Ltd.	Coal conveyers.
Callender's Cable and Construction Co., Ltd.	Electric cables.
Herbert Morris, Ltd.	Overhead travelling cranes.
British Westinghouse Electric and Manufacturing Co., Ltd.	Switchgear.
Crompton & Co., Ltd.	Arc lighting.
Robson & Coleman	Electric lighting.
Falconer, Cross & Co.	" "
W. Taylor & Co.	" "
King & Co., Ltd.	" "
Cox-Walkers, Ltd.	Lamp standards.
Chamberlain & Hookham, Ltd.	Electricity meters.

The quay crane here illustrated is one of 25 cranes made by Messrs. Royce, Ltd., Manchester, of the travelling gantry or portal type, each of 3-ton capacity. The cranes are fitted with the Musker-Davidson patent balanced luffing gear, and all the motions are electrically driven. The maximum radius of the jib is 50 ft., minimum 20 ft., and the luffing speed at the hook is 150 ft. per minute. The hoisting speed with 3 tons is 150 ft. per minute, with 1½ tons 250 ft. per minute; slewing speed at hook 400 ft. per minute, travelling speed 30 ft. per minute. The height from the

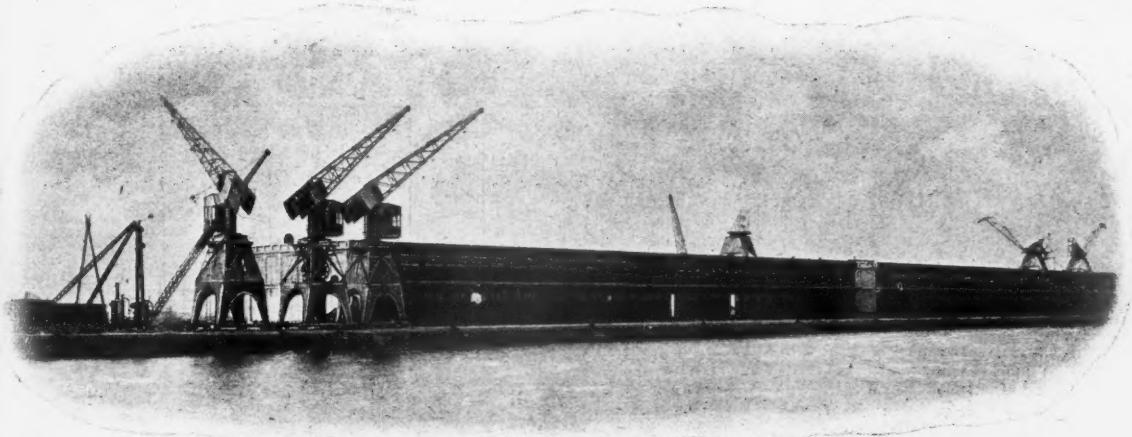


Photo by] [*Photochrom Co., Ltd.*

HULL JOINT DOCK. FERRO-CONCRETE WAREHOUSES AND CRANES, NO. 3 QUAY.

crane rails to the point of the jib at maximum radius is 80 ft. The hoisting motor is of 45 B.H.P., slewing 5 B.H.P., luffing and travelling each 8 B.H.P. The electrical gear is of "Royce" manufacture throughout. The motors are of the totally-enclosed type, six hours' rating; the controllers are of the tramway type, of exceptionally robust construction to stand heavy usage. The travelling rail centres are 15 ft., and the wheel base 19 ft.

For a test of stability the cranes were subjected to a load of 6 tons on the hook at the extreme radius in any position of the jib, without any support from jacks or rail clips, and withstood the test successfully, there being no indication of the slightest lift on the structure or wheels.

Each crane is supported on four cast-steel travelling wheels with single flanges on the inside. The travelling motion only is fitted with hand gear. Automatic electrical safeguards against over-running in either direction are provided for the hoisting and luffing motions. All the toothed gears on the crane (except motor pinions, which are of raw hide) are of cast-steel, machine-cut throughout. Each motion is fitted with an electrical brake, and in the case of the hoisting motion a powerful foot-brake is also provided on the barrel shaft, and is used for quick lowering without current. In such circumstances the electrical brake is held off by a hand release device. The gear for the motions of hoisting, slewing and luffing is carried on a central revolving mast, which is pivoted and supported at the foot in a cast-steel footstep bearing, and at about the centre of its length by a roller path. The jib is carried at the top end of the mast by a heavy fixed shaft, and is balanced by c.i. weights fixed at the tail end of the jib structure.

The special advantages of the luffing arrangements are that the load during luffing is not lifted as in the ordinary jib crane, but moves in a horizontal line, and, consequently, a great saving of power is effected, and a small motor only is required. In addition, a quick luffing speed is permissible.

The position of the crane driver enables him to command in his view the whole of the movements of the hook and loads.

Current is conveyed to the cranes through heavily armoured cable from plug-boxes fixed at intervals along the quays, and each crane is provided for this purpose with a revolving cable-drum on one of the bottom carriages.

(To be continued.)

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. A. B. EALES, technical assistant and testing engineer at the Stoke-on-Trent Electricity Works, has resigned, and is returning to Johannesburg. His successor is MR. N. H. BARKER, of Fulham, appointed at a salary of £140 a year.

The Manchester Electricity Committee has appointed MR. W. DUNDAS, a member of the staff, as resident engineer at the Dickinson Street and Bloom Street electricity stations, to succeed Mr. F. H. Whysall, who has taken up the position of chief electrical engineer at Greenock. Out of 74 applicants for two positions as shift engineers at the generating stations at Manchester, MR. E. ATKINSON and MR. J. H. NIVEN were appointed.

After considerable discussion the T.C. has raised the salary of MR. J. W. HODFIELD, electrical engineer, Barnstaple, to £225 from £200, which has been the salary since the inception of the undertaking 12 years ago.

At the Keighley T.C. meeting last week, the Electricity Committee recommended that the salary of the borough engineer (MR. H. WEBBER) be increased from £300 to £400 per annum. An amendment was moved that the increase be only £25, and this was carried after a suggestion had been made that rather than increase the engineer's salary, an assistant should be appointed at £100 a year. A further amendment was also moved that the increase be £50, but this was defeated by one vote.

The Wimbledon Corporation Electricity Committee recommends that the salary of MR. R. W. KLITZ, chief assistant electrical engineer, be increased from £225 to £250 per annum.

General.—Among the new magistrates appointed for Lancashire, MR. THOS. WILKINSON, founder and managing director of Thomas Wilkinson, Ltd., electrical engineers, of Arnside, is included.

The marriage took place last week at Boroughbridge (Yorks.) of MR. C. F. DAWSON, assistant electrical engineer at New Bromsgrove, under the Worcestershire County Council, and Miss S. Langley.

The directors of the Metropolitan Railway Co. have elected SIR CLARENDON GOLDING HYDE, deputy-chairman of the company.

The Council of the Institution of Electrical Engineers has elected MR. H. C. LEVIS to be an Ordinary Member of Council in the place of the late Mr. A. B. Anderson.

MR. W. C. MOUNTAIN, consulting engineer, Newcastle-on-Tyne, announces that to meet the requirements of his increasing practice, he has opened an office at 66, Victoria Street, Westminster, S.W. Mr. M. B. Mountain, who will be associated with him in the conduct of the London business, is resident in London.

MR. GILBERT, late director of the Gilbert Arc Lamp Co., Ltd., and of Engineering and Arc Lamps, Ltd., has disposed of his entire interests in these concerns, and can be consulted on arc lamps and engineering matters generally at 9, Birchington Road, West Hampstead.

We regret to learn that MR. BARRALET, who was present with Mrs. Barralet at the I.M.E.A. Convention at Birmingham, was suddenly taken ill last week, and he has since undergone an operation for appendicitis. His illness has, unfortunately, prevented him from keeping a number of appointments and from advising his friends of the reason. We are requested by Mrs. Barralet to publish this information, and we would add our wishes for Mr. Barralet's speedy recovery.

On June 18th, at Chinley Chapel, Derbyshire, MR. T. TALLENT-BATEMAN, A.M.I.E.E., was married to Jane Catherine, daughter of Mr. Hugh T. Hughes, M.S.M. and C.E., of Chapel, surveyor to the Derbyshire County Roads. In commemoration of his marriage, Mr. Bateman was presented with a massive grandfather clock by his friends at the British Westinghouse Co., where he is chief switchgear engineer.

Obituary.—The death, at the age of 41, of ENGINEER ARTURO FELIPE BONO, director-general of the Compania Italo-Argentina de Eléctricidad, occurred last month. Senor Bono was at one time Professor of Electricity in the Argentine Naval Gunnery School, and afterwards engineer to the Compania Alemana Trans-Atlantica de Eléctricidad, subsequently attaining the position of vice-director. He retired from that company in 1912, and, on the formation of the Italo-Argentina Co., was offered and accepted the position of managing director.—*Review of the River Plate.*

MRS. G. WESTINGHOUSE.—We are informed that news has just come to hand by cable from New York of the death of Mrs. George Westinghouse, who therefore survived her husband by only two months.

NEW COMPANIES REGISTERED.

Direct Copper Production Syndicate, Ltd. (136,536).—This company was registered on June 20th, with a capital of £10,000 in 6,000 "A" and 4,000 "B" shares of £1 each, to take over certain inventions relating to processes and apparatus for the direct production of copper cathode plates, sheets tubes or wire from copper ores, or from crude copper, and to adopt an agreement with Sherard Cowper-Coles. The subscribers (with one share each) are:—E. M. Fox, 6, Charles Street, Berkeley Square, W., gentleman; Sherard Cowper-Coles, 1-2, Old Tye Street, Westminster, electro-metallurgist. Private company. The number of directors is not to be less than two or more than five; the first are Sherard O. Cowper-Coles, J. J. G. Gordon, T. Bolton, E. M. Fox and the Right Hon. Sir T. Vesey Strong, P.C., K.C.B.; Sherard O. Cowper-Coles may retain office for life, and may, while holding 2,000 shares nominate one director (or, if he resigns, two directors); qualification, £100. Solicitors, Edgar Smith & Co., 22, Francis Street, W.C.

South Wales Wireless Training Colleges, Ltd. (136,585).—This company was registered on June 23rd, with a capital of £1,500 in £1 shares (1,498 "A" and 2 "B"), to carry on the business of a college or school for instructing pupils in wireless telegraphy or telephony, &c., and to adopt an agreement with J. B. Schofield. The subscribers (with five shares each) are:—W. L. Yorath, Strathlyn, Lake Road, E. Cardiff; H. B. Taylor, Cleethorpes, Stanwell Road, Penarth, manufacturer's agent. Private company. The number of directors is not to be less than two or more than five; the first are W. L. Yorath and H. B. Taylor, each of whom may retain office for life; qualification, £75; remuneration as fixed by the company. Registered office, Market Buildings, St. Mary Street, Cardiff.

Electro Motor-Hiring, Ltd. (136,627).—This company was registered on June 25th, with a capital of £10,000 in £1 shares, to sell, let on hire, repair, construct and connect cables, wires, lines, dynamos, accumulators, motors, meters, galvanometers, ammeters, voltmeters, telephones, fans, carbons, switches, cut-outs, generators and distributors of electricity, fittings, brackets, cinema and other lanterns, X-ray apparatus, lamps, globes, films, &c. The subscribers (with one share each) are:—U. Crossley, the Grange, Hindhead, Surrey, gentleman; E. N. Whitley, Hadlow, Halifax, solicitor. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first three. qualification, £100. Solicitors, Hirst, Whitley & Akeroyd, Halifax and Bradford.

J. Whitehouse, Ltd. (136,569).—This company was registered on June 23rd, with a capital of £3,000 in £1 shares, to take over the business of an electrical engineer, and contractor and decorator, and dealer in electrical goods and materials, carried on at 15, The Parade, Golder's Green. The subscribers (with one share each) are:—J. R. Whitehouse, 15, The Parade, Golder's Green, N.W., electrical engineer; Mrs. F. M. Whitehouse, 43, St. Andrew's Road, Golder's Green, N.W. Private company. J. Whitehouse is permanent managing director

Duncan's Electricity Supply, Ltd. (9,173).—This company was registered in Edinburgh on June 24th, with capital of £25,000 in £1 shares, to carry on the business of an electrical supply company, and to acquire from J. Duncan rights in connection with the supply of light to Aboyne, Ballater and Ellon. The subscribers (with one share each) are:—J. Duncan, Tillycorthie, Aberdeenshire, landed proprietor; R. Watt, 469, Great Western Road, Aberdeen, banker; J. H. Edwards, 1, Golden Square, Aberdeen, advocate. Private company. The number of directors is not to be more than five; the first are J. Duncan, R. Watt and J. H. Edwards; qualification, 500 shares. Registered office, 1, Golden Square, Aberdeen.

CITY NOTES.

Aron Electricity Meter, Ltd.

THE annual meeting was held at Winchester House, E.C., on Tuesday, Mr. H. Hirst presiding.

The CHAIRMAN, in proposing the adoption of the report (ELECTRICAL REVIEW, page 1084), said they had every reason to be satisfied with the result of the year's work, although the net profits attained were about £4,000 less than last year. They had done a larger business in Germany, with corresponding better results, and they had to record a similar agreeable experience in England and France. In Austria-Hungary they had suffered from severe stagnation of business, from causes not their fault. Those who knew the conditions that had obtained in that country during the Balkan War must realise that all building operations, all contracting work, and practically all construction work were stopped, with a consequent decrease of turnover and loss of profits to them, and the result that the contribution to the balance-sheet from that country was adversely affected to the extent of £8,000. It was very encouraging to note that during the first three months of this financial year business in Austria-Hungary had resumed a condition which was more normal, and their sales, and he hoped their profits, in the present year ought to be considerably better. The conditions in Austria and Hungary made it necessary that they should establish there suitable factories and establishments, and the additional capital expenditure of £24,000 last year had been principally in connection with this item. For the carrying on of the business in Hungary they had recently formed a Hungarian company, in which they had the assistance of influential gentlemen of that country, and he hoped that their business there would be considerably augmented by this enterprise. In reply to various letters which he had received, he would like to take that opportunity of explaining that although they found it proper and necessary to carry on their business in the various territories where they operated under the title of companies formed according to the laws of the different countries, companies which were capitalised in a manner suitable for the trade they were doing in those countries, the Aron Co. was the sole owner of those different foreign companies. It was merely a matter of expediency and helpful to business, in fact under other conditions it might be impossible to do business at all in some of the highly protected countries of the Continent. He was frequently asked on those occasions why they still put together under one heading, amounting to over £200,000, such different items as goodwill and patents, land, buildings, machinery, tools, and the like. Shareholders liked to compare one balance-sheet with another, and they did not like to make any change in the form unless there was some specific reason for doing so. He held out the hope last year that the board might decide during the year just closed to have the assets of the company valued and thus it might be opportune to split up those various items under different headings; the shareholders would thus be able to see what were their assets and what amount still stood in the books as the value of goodwill and patents. It had been impossible to make this valuation during the past 12 months, but the matter was now actually in hand, and when they met again the directors hoped to be able to place a report before the shareholders, according to which it might be their pleasure to consent to a different rendering of the accounts in future. With regard to the other items in the balance-sheet, the depreciation had increased by about £2,000 because for the first time they had to include the new Vienna factory, and though this was quite new they had thought it wise to depreciate it already by some £1,660. The business of the first three months of this year showed an increase over the corresponding period of last year all through the company, but the general outlook of industrial affairs in this, and all other European countries, was at present not over bright. He could only hope that the clouds might pass away, so that they might have a year of undisturbed work before them. The most important event during the past year, however, was not a matter of trade or finance, it was the death of their managing director and the founder of the company, Prof. Aron. It was a great loss to the company, but a much greater loss to those who had had the good luck to work with him, and who had had the opportunity to appreciate his great qualities. He (Mr. Hirst) felt confident that now that the business had emerged from the evolutionary and inventive stage, and had entered the ranks of mere industrial undertakings, they would be able to hold their own with the assistance of the staff on the designing, manufacturing and commercial sides. It was very difficult to find for the position of managing director an absolute successor to Prof. Aron. He hoped the shareholders would approve of the action the board had taken, for which he took full responsibility. After interviewing every man who could possibly be considered, he came to the conclusion that the interests of the company would best be served if they appointed Mr. Manfred Aron, the son of the late Professor, to fill his chair. Mr. Manfred Aron had distinguished himself in an administrative capacity in the company, and his father had, to his (the chairman's) knowledge, a very great opinion of his ability, which he expressed repeatedly; he had a large holding in the company, he was the representative of his family, who also had a large holding, he bore the honoured name of Aron, and he knew that amongst the many enterprises of his father their company was nearest to his heart. The whole staff found this selection a suitable and proper one, and they were one and all willing to transfer their allegiance and loyalty to the son of their former chief. He (Mr. Hirst) had personally promised to give Mr. Manfred Aron every assistance in the great task he had undertaken, and he felt that he had acted in accordance with the wishes of the shareholders by agreeing to act as joint managing director with him for a period of two years. He was happy to state that his close intercourse with Mr. Manfred Aron and his work during the past few months had proved that their selection had been quite right, and that he would be capable of fulfilling his task like a true chip of the old block.

SIR JAMES PENDER, Bart., seconded the motion, and after some reference by shareholders to the loss of Prof. Aron, the report was adopted.

Montreal Light, Heat and Power Co.

FOR the fiscal year ended April 30, 1914, the gross revenue was $6,245,697, operation and maintenance cost $2,778,451, depreciation and renewal reserve $600,000, leaving as net revenue $2,867,246, less fixed charges $467,977, making the net income $2,399,269. Dividends paid amount to $1,275,000, and dividend payable, May 15th, 1914, $425,000, leave the surplus from the year's operations $699,269, less officers' and employés' pension fund $10,000. The gross revenue and surplus earnings show substantial and satisfactory increases over the previous year, notwithstanding increased operating expenses occasioned by advanced prices for raw materials, notably coal and oil for gas manufacture, and low water and ice conditions at the company's hydro-electric plants, necessitating extended operation of steam plant and purchase of additional power. The net revenue and net income, if accounted the same as in previous years, would also show substantial increases, but in the preparation of this year's accounts and to conform with the more modern practice of conservatively managed public utility companies, the directors have deducted depreciation and renewal reserve before instead of after arriving at net revenue, and the net revenue and net income are by comparison affected to that extent. The constantly increasing cost of raw materials has caused the management much concern, and while the directors propose a further concession in gas rates for the coming year, this condition if continued will seriously affect the cost of manufacture of gas in the future.

The continuous growth of the business adds emphasis each year to the necessity of providing adequate reserve for depreciation and obsolescence of buildings and equipment, and in view of the constantly changing methods and equipment, the depreciation reserve must be ample to take care of these conditions. In the meantime this and other reserves are invested in revenue-earning plant, and the public is getting the advantage of the use of this large investment upon which no dividend has to be earned.

The new steel pole transmission line between Cedars Rapids and Montreal is under way and will be completed simultaneously with the hydraulic development of the Cedars Rapids Manufacturing and Power Co., with whom the company has contracted for part of its power supply. The company's new ten storey addition to its office building was completed during the year.

It will be necessary to make the usual large extensions to both the gas and electric distributing systems to meet the constantly increasing demand for service in the newer sections of the city and suburbs. Notwithstanding increased costs reflected in the operating expenses, the directors have decided to make further concessions in both gas and electric rates and in due course will announce a reduction of 5c. per 1,000 cubic feet in the price of gas, equal to upwards of 5¾ per cent., and 4/10c. per K.W.H. (for overhead service) in the rate for electric incandescent lighting, equal to upwards of 6⅔ per cent. The directors regret that they cannot consistently reduce the electric lighting rate for underground service; in fact the great difference in costs for this class of service as demonstrated by the cost of the new civic conduits and equipment will render it necessary to establish some fair differential to offset the additional cost entailed, and as the civic conduit system is extended into new territory, the consumers there will be required to pay increased rates for service. With these reductions the maximum rate for gas will be 85c. net per 1,000 cubic feet, and the standard rate for electric incandescent lighting (overhead service) 6c. net per K.W.H., which compares most favourably with rates charged elsewhere.

Bombay Electric Supply and Tramways Co., Ltd.

The annual meeting was held on June 23rd at the Electrical Federation Offices, Kingsway, W.C., Sir Charles Ollivant, K.C.I.E., presiding.

In moving the adoption of the report (Elec. Rev., Vol. 74, p. 1003), the Chairman remarked that the report, like others of recent years, showed steady progress in the earnings of the undertaking. It showed that the net receipts for the year were £145,572, compared with £128,682, an increase of £16,890, which was equivalent to 13.12 per cent. The past year's results of the working of the traction branch, which still continued from the revenue standpoint the most important branch of the undertaking, showed an improvement. The proportion of expenditure to receipts had fallen from 49 per cent. to 48 per cent., and the net earnings had advanced from £84,820 to £89,548. This increase, however, could not be wholly assigned to growth in their traffic, as a considerable portion of it was due to the fact that they were justified last year, in consequence of their lower generation costs, in reducing the rate at which their supply branch sold electrical energy to the traction branch from 1.5 annas per unit to 1.3 annas per unit. The company carried 40,692,000 passengers on the lines last year, against 38,613,000 in 1912, an increase of 5.2 per cent. During the first five months of the current year their gross traffic earnings had recorded a further comparative growth of 5 per cent. The directors had applied for municipal sanction to lay an extension of the tramway along a considerable portion of the new Sandhurst Road, which promised to become the principal east to west trunk thoroughfare of the city. The question of the introduction of an experimental service of motor omnibuses was discussed by the managing director with the authorities concerned, during his recent annual stay in Bombay. There appeared to exist a consensus of official opinion that these vehicles were unsuited to the local conditions of the city, while, after giving to the matter very careful study, the directors were convinced that they could not be operated at a profit, except upon a scale of fares considerably above those in force upon tramways. To the introduction of an experimental service of railless trolley cars the same objections did not to an equal extent apply, and the directors were hopeful of being enabled to inaugurate a service in the not distant future. The business of the electric supply branch of the undertaking continued to show a steady progressive expansion. The many advantages of electric lighting over all competitive illuminants, coupled with the cheapness of the company's rates, appealed more and more to the people of Bombay, and from all districts of the city, applications for connections flowed in to an extent with which it was not always easy to keep pace. What he had said about the growing popularity of electric lighting, applied no less to electric fans. The growth of the company's power load for industrial purposes, was also a very welcome feature. Their sales of electric energy for power—apart from traction and from fans—aggregated 1,882,111 units against 1,103,824 units in 1912, and important developments lay ahead of them. So far in the current year there had in their supply branch been no abatement in their upward progress. During the year the capital expenditure amounted to £58,315, of which £51,993 was for the electric supply branch, chiefly for extensions to mains; the balance of £6,322 was the capital outlay in the tramways branch, mainly upon additions and improvements to the rolling stock. The investments which the company held on account of the depreciation and sinking funds were taken into the balance sheet at their cost price of £62,656. In recommending the payment of a dividend of 6 per cent. upon their ordinary shares out of the available balance of profit after meeting fixed charges, and providing what they regarded as adequate provision for their depreciation and sinking funds, the directors were making no departure from the financial principles which had throughout governed their administration of the company's affairs. When they assumed office nine years ago they found, through no fault of their own, the company burdened with a heavy capitalisation, a considerable proportion of which was unrepresented by any tangible assets, owing to the facts that a large sum had to be paid to the old tramway company for goodwill under the terms of its agreement with the municipality, and that heavy expenditure for underwriting, promotion and other similar claims had to be disbursed to the parties entrusted by the municipality with the raising of the necessary capital for financing the purchase of the old and the electrification of the new undertaking. The company took over the tramways weighted under the new concession with various obligations restricting their fares, from which the old company was free, and they were faced with the electrification, extension, and remodelling of its services. The supply branch, an entirely new business in Bombay, had to be established, organised, and developed. That being the situation the directors held that their first duty was to place the company on a sound financial basis. They arranged by the provision of an adequate sinking fund, the annual instalments to which were a charge against revenue, to amortise within the period of the concession, that portion of their capital not represented by tangible assets and which might therefore not be covered by the purchase price estimated to be payable by the municipality, should it exercise its option of acquiring the company's undertaking which would arise in 1947. They also had established a depreciation fund, their annual revenue contributions to which were estimated to provide for the replacement, when required, of all wasting assets of the business to which they could assign a definite life, to the credit of which account they had now £90,267, two-thirds of which were invested outside the business. Auxiliary to this, they had a small special reserve fund of £5,000. Since these funds were created they had further safeguarded and strengthened the prospective position of the shareholders, by providing that their second debenture loan of £200,000 should be repaid by annual drawings, which were also a charge against revenue, with the effect that the whole of this indebtedness would have been paid off by the year 1937, when the company would hold, free of cost, the additional tangible assets created by the expenditure of this £200,000. The policy he had outlined did not permit of the company paying any dividend to their ordinary shareholders for a few years, namely, until in the opinion of the board the financial provision the directors had made, the investment in their business of a considerable portion of their surplus revenue, and the expansion of their earnings, had justified a distribution. But he hoped these shareholders would admit that they had now received compensation for their patience in the handsome capital appreciation of their holdings which had taken place, and he believed they would concur with him that the price at which their stocks were quoted that day, both on the Bombay and the London markets, furnished a complete justification for the policy which the directors had pursued. There was another principle which they had always kept in view and acted upon, and that was not to declare a rate of dividend which they had not the fullest expectation of being able to maintain. With regard to the future, they were justified in anticipating a continuance in the steady progress of the business. New capital expenditure on extensions of their mains and tracks required time to fructify. In regard to the increase in capital foreshadowed in the report, the growth of their undertaking had outstripped their present resources, and these demanded augmentation in order that they might be enabled to make adequate provision for the profitable developments which lay ahead of them. A notice to their shareholders summoning a general meeting, to which their proposals would be submitted, would shortly be issued. He believed that the terms upon which the directors proposed offering to the shareholders the subscription of a further issue of the company's shares would prove attractive to them. The directors greatly regretted to be deprived of the services of a chief engineer of the great abilities which Mr. Cooper possessed. It was a source of satisfaction to them that Mr. Cooper had since been able to join the board. Consequent on his resignation of his position in Bombay the directors decided to divide Mr. Cooper's responsibilities between Mr. Baker and Mr. Moberly, his immediate lieutenants there. Subject to the control of the managing director, the former of these gentlemen was now at the head of the supply and the latter of the traction branch. The directors' expectations regarding them had, he was glad to tell the shareholders, so far been fully justified, and they had been well seconded by Mr. Lucas, Mr. Fowler, Mr. Mahaluxmivalah, and by the whole staff. No appreciative survey of their affairs, present or prospective, would be complete without a recognition of their obligations to the Managing Director, Mr. Rimington.

Mr. F. C. Rimington (the Managing Director) seconded the motion, and stated that he had been asked by the Chairman to refer to a telegram which had been received from Bombay in regard to the gross earnings for the five months ending on May 21st last. These showed an increase of 12.4 per cent. as compared with last year and of 8.3 per cent. with the previous year, which was equal to an increase of about 50 per cent.

The motion was carried unanimously.

South American Light and Power Co., Ltd.—The directors report that the net profit for the year to March 31st is £11,782. A dividend of 5 per cent. on the £172,400 capital issued is recommended, requiring £8 620; there is written off the debenture issue expenses £3,000, leaving to be carried forward £517. The receipts show a considerable increase over those of the previous year, but, owing to the poorness of the last Argentine wheat crop, little, if any, increase in the receipts can be expected for the coming year.

Credenda Conduits Co., Ltd.—After writing off the goodwill account £1,000, the directors recommend a dividend at the rate of 8 per cent. per annum on the ordinary shares for 19 3, carrying forward £714.

Edmundsons' Electricity Corporation, Ltd.—The directors report steady progress. The net profit is £23,125, an increase of £4,226. After putting to reserve £9,000, and paying the preference dividend, £12,000, £2,125 is carried forward.

Stock Exchange Notice.—The Committee has ordered the following to be quoted in the Official List:—North Metropolitan Electric Power Supply—Further £100,000 6 per cent. cumulative preference stock.

"Harper" Electric Piano (1910) Co., Ltd.—A dividend for the half-year ended June 1st is announced at the rate of 4 per cent per annum.

Held Over.—Pressure upon our space compels us to hold over reports of several City meetings until next week.

Cape Town Consolidated Tramways and Land Co., Ltd.

IN the course of their report for the year ended December 31st, 1913, the directors state that the operation of the Camps Bay Tramways has resulted in a profit of £1,599, against a profit of £2,973 in the previous year, and the number of passengers carried shows an improvement of 33,119, but the increased price of coal, the extra expenditure on permanent way and the damages paid and expenditure incurred in connection with the accident early in the year, has resulted in a reduced balance of profit in spite of increased traffic.

At the annual meeting held on June 24th, at 1, London Wall Buildings, E.C., Mr. ROBERT LITTLEJOHN (the Chairman) said that taking the results for the past year as a whole, they could not say that the company had done more than maintain its position without serious loss. It had had no revenue from its subsidiary companies, and none of them had achieved results sufficiently satisfactory to enable them to pay a dividend during the past year. So it had practically been out of the cash balance on hand at 31st December, 1912, that this company had paid its administration expenses, £1,790, and advanced a further £342 to the subsidiary companies. Referring to the subsidiary companies, he said that as regarded the Camps Bay Tramway Co., Ltd., although the traffic increased during 1913, the net result was a diminished balance of profit to the extent of £1,370. This was due in a measure to an unfortunate accident on the company's tramway in March, 1913, but principally to the increased price of coal at Cape Town, and to certain necessary renewals to plant and permanent way. They could only expect steadily better figures in the future from the operations of the tramways if the resident population at Camps Bay materially increased. It was increasing, and no doubt would continue to increase; but not as rapidly as could be desired. Under the ordinance in terms of which Camps Bay was absorbed into the enlarged municipality of Cape Town, that municipality had to spend £12,000 on public improvements at Camps Bay during the next three years. The expenditure of that amount on well-considered public improvements, and the expenditure gradually by the company on bungalows and cottages for sale, of the amount to be received from the municipality for public works and improvements already provided by the company, should materially increase the amenities and the resident population of Camps Bay, and consequently enhance the value, not only of that estate, but also of the tramways. In the future it should be as much in the interest of the municipality as of the company that Camps Bay should be judiciously developed and made as attractive as possible to permanent residents as well as to temporary residents and other visitors.

Mr. LUDWIG BREITMEYER seconded the motion, which was carried.

National Telephone Co., Ltd.

MR. GEO. FRANKLIN (Liquidator) presided on June 25th at Hamilton House, Temple Avenue, over a meeting of the shareholders of this company, when the report (ELEC. REV., Vol. 74, p. 1043) was presented.

The LIQUIDATOR explained that the meeting was called under the Act to enable him to place before the shareholders a report of his acts and doings in regard to the winding up, and the report now presented was a record of the concluding stages of the winding up, every step of which had been full of pitfalls and difficulties. With regard to the report, the second paragraph showed how matters in issue with the Postmaster-General as the result of the appeals by him and by the company had been disposed of. It was shown that whereas he objected to certain sums, amounting to £397,000, being included in the award, he was enabled, by making a sacrifice of £45,000, in addition to the costs of the arbitration, to which the company was entitled, to make a settlement and so avoid prolongation of litigation. Paragraph 3 explained in a few lines the final result of many months of patient investigation. The presentation of their claim to the Railway and Canal Commission occupied many months of strenuous effort, and although the final result to the shareholders might be somewhat disappointing, he did not think that anything was lacking either in the manner of its presentation or in the preparation of the evidence offered to the arbitration tribunal. The Liquidator referred to the difficulties which had arisen in regard to the unclaimed dividends, and as to deposits paid by subscribers in regard to trunk services and postal facilities in respect of which such subscribers had ceased to exist. On February 9th an Order of the Court was made to deal with this matter, with the result that a final payment was made to the deferred shareholders of 1.48 per cent., making up a total of 105.48 per cent. In paragraph 8 reference was made to the loss of realisation on Exchequer bonds. The directors, in common with the shareholders, regretted the attitude which the Postmaster-General took up in insisting on his pound of flesh, although the circumstances had greatly altered from the time when the agreement was made, but as the Postmaster-General had decided on it, and as the board were advised that he was within his legal rights, they felt that there was nothing further to be done. As to the costs of the proceedings, he did not think that the amount of 1.32 per cent. of the sum realised could be considered excessive. The Liquidator proceeded to give the various dates on which the different steps necessary to be taken were commenced, which, he said, showed that they had not had a restful period since the company went into liquidation. Hardly a day passed without some steps having to be taken to bring about some decision. He had on other occasions expressed the indebtedness of the company to their officers for the great services rendered to him, and he repeated that they owed much to the skill and ability shown in relation to their affairs. Everything, he thought, had been done to produce the best possible results for the shareholders.

Mr. S. H. SANDS formally moved the adoption of the report and this was seconded by LORD HARRIS and carried.

Replying to a vote of thanks, the CHAIRMAN expressed regret that the connection between the directors and the shareholders had been brought to a close. Had the shareholders known that their recompense for putting their money into the business for thirty years, was to be an annual dividend of never more than 6 per cent., and sometimes nothing at all, with a return at the end of £105 for every £100 put in, he rather thought they would never have invested their money in the business. He considered they had been treated in a grossly unfair manner, but there was nothing more to be done.

Consolidated Diesel Engine Manufacturers, Ltd.

AN extraordinary general meeting of the shareholders of this company, which was very largely attended, was held on Thursday, June 25th, at Salisbury House, E.C., under the chairmanship of Mr. J. M. FELLS.

The CHAIRMAN, in proposing a resolution for the voluntary winding-up of the company and the appointment of Sir W. B. Peat as liquidator, delivered a long speech in which he gave a history of the proceedings in connection with the company for the last seven months, during which he has been Chairman. He recalled the meeting in December last at which, he said, he told the shareholders that in his opinion grave errors of judgment had been committed by the board; that in the administration of the company there had been want of method, slackness of procedure, lack of engineering exactitude and looseness in the wording of contracts. On the other hand, the directors, in carrying out their bargains with buyers, had been almost quixotically correct. At that meeting he moved the appointment of a committee to enquire into the causes of the company's position, to advise as to remedies and to deal with the question of the board, and the possibility of reconstruction. That committee was not unanimous in its report, but the majority favoured reconstruction with an assessment, on the basis of the Ipswich works alone, and an arrangement by which the members of the Carels family should purchase from the company the shares which that company held in Usines Carels Frères. At the meeting in February last those proposals were rejected. Subsequently, the directors met some of the largest shareholders to see whether some agreed scheme could be brought forward, and on March 10th a meeting of large shareholders was held at which various schemes were discussed, and it was decided that the further necessary funds ought to be raised by a participating preference share issue. Shortly after that meeting negotiations were opened with a well-known financial house on the basis of the suggestions made at the meeting on March 10th, and on April 14th a meeting took place between the proposed underwriters and representatives of the company, as a result of which the underwriters expressed their willingness to proceed further in the matter, subject to their being satisfied on certain points. That proposed scheme involved a re-arrangement with the Usines Carels Frères, involving re-organisation of the relations between the two companies, and that scheme would have come before the shareholders for their ratification. On May 16th Mr. Peddie, who had taken a leading part on the committee, wrote stating that at the next meeting he would propose the election of himself and the Hon. F. N. Stanley as directors. On May 22nd representatives of the underwriters expressed a doubt as to whether the gentlemen who had provisionally agreed to act as directors to replace the present board would do so if there was to be any controversy as to the constitution of the new board. In the end the negotiations were broken off and the board came to the conclusion that voluntary liquidation was the best course to be adopted. It might be that the liquidator would find the only solution in a simple sale of the property, but in view of the trade accounts, the contracts still current, the potentialities of the business, and its association with the name and personality of a great inventor, the liquidator might find it possible to effect a better arrangement by reconstruction than by sale.

Mr. BALL (a shareholder) seconded the resolution. He remarked that they had a fine asset in the half-share which they possessed in Messrs. Carels Frères business plus one vote. He hoped that on no account would the liquidator part with that asset except for a considerable sum. They seemed to have had no representation on the board of that concern and no dominating influence which gave them any power even to regulate the making up of the accounts. The directors of that company had been able to do just what they liked, and it was almost impossible for anybody to imagine how such an arrangement could have been entered into by a body of business men. He considered that the shareholders had been robbed, but even the shareholders' committee did not make any suggestion that a prosecution could lie against anybody. Under the circumstances he thought the best thing was to wind up under the direction of Sir W. B. Peat, who would see to it that the best that could be done for the shareholders would be done. If that was done they would get something, but if the company

was handed over to Mr. Peddie and his friends he did not believe that the shareholders would get a sou out of it.

Mr. T. TAYLOR PEDDIE made a long speech traversing the Chairman's statement in many directions. The promotion of the company was, he said, one of the biggest ramps ever perpetrated on the London public, and he had no intention of leaving the gentlemen alone who were responsible for it, especially when he knew that the internal arrangements of the company still required to be adjusted. It was under the original agreement that the high-speed engines, the half interest in which was bought by the company from Carels Frères and which had since proved an utter failure, were supplied, and upon which the great losses were incurred. The directors had blamed Mr. Bathe, their former managing director, for the losses so incurred, but it must be obvious that Mr. Bathe could not be responsible for the manufacture and design of engines manufactured at the works of Carels Frères. Coming to the crux of the question he held that Messrs. Carels were responsible for a very large portion of the losses incurred. He hoped that if liquidation was to come the shareholders would reject the proposal of the directors and insist upon a compulsory winding up under the supervision of the Court.

After considerable discussion the resolution was defeated on a show of hands by 38 votes to 28. The Chairman thereupon demanded a poll to be taken immediately.

On the motion of SIR ROBERT FILMER a resolution was carried to the effect that in the opinion of the meeting the liquidator should not employ any firm of solicitors who had previously done business for the company.

The result of the poll as published in the Press shows:—For the resolution, 264,586; against, 115,163. The directors' resolution for voluntary liquidation has therefore not been carried by the necessary three-fourths majority.

THE petition of Walter Laurence & Son for a compulsory order to wind up Consolidated Diesel Engine Manufacturers, Ltd., came before Mr. Justice Astbury in the Companies Winding-up Court on Tuesday. Mr. F. Russell, K.C., for the company, asked for an adjournment for a week. The company, he said, had taken a vote on the question whether there should be a voluntary winding-up and on a show of hands that proposal was defeated. A poll was demanded and had been taken, but a question had arisen as to whether certain votes were valid.

MR. OWEN THOMPSON, on behalf of the creditors for over £7,000, opposed the adjournment. He said the company held 90 per cent. of the shares in a subsidiary company and they could vote for a voluntary winding-up of that subsidiary company during the week.

MR. RUSSELL gave an undertaking that the company for which he appeared would not exercise their voting power in that connection.

The petition accordingly stood over for a week.

Russian Wireless Telegraph and Telephone Co.

THE *Financial Times*, of June 24th, contains a translation of the report of this company for the year ended 31st December last, which was submitted to the shareholders' meeting on 31st May. The gross receipts from work carried out have reached the sum of 307,068 roubles, against 250,189 roubles during the previous year, and the net revenue was 140,219 roubles, against 139,801 roubles, in spite of the considerable increase of general expenses in 1913. This increase, amounting to 166,651 roubles, was partly due to the very high rate of interest paid owing to the state of the financial market, on the capital borrowed for the purpose of satisfying the company's requirements in ready money, and partly to the necessity for enlarging the premises and increasing the number of employees, to deal with the growing business. Further, a very important fact in this respect is the large amount of orders not completed by 31st December, 1913, especially in connection with the contract entered into with the Military Engineering Department for the erection of a station of high power. The resolution regarding the increase of the capital to 3,000,000 roubles has now been carried out, nearly all the shares of the new issue having been acquired by the old shareholders; but in order further to improve the financial position the directors propose to increase considerably the capacity of the works by erecting a special building and providing it with additional equipment. During the last twelve months many new improvements of a technical character have been carried out, and these improvements will still further increase the demand for wireless communication. Special attention has been paid to the installation of high-power stations especially for commercial purposes. Instruments have been designed for the automatic transmission as well as for the automatic recording of messages, thus enabling the stations to increase to a large extent their working capacity. Besides the installation of stations of high power, in the company's laboratories work is being continued in connection with the construction of special types of military and marine stations, and in a short time the company will be able to put some of their apparatus on the foreign market. Lately much attention has been paid to the designing of special types suitable for the requirements of mercantile shipping. It was foreseen long ago that wireless telephony would become possible, but many technical difficulties were met with in preparing to bring it into practical use. Recently these difficulties have nearly been overcome, and the possibility of adopting wireless telephony for military, naval and commercial purposes is becoming an accomplished fact. Finally, it is an interesting fact for shareholders that the station has recently successfully communicated with a Marconi station of high power in Wales and has exchanged messages with that station. This is the first time in the history of Russia that messages have been exchanged direct with Great Britain by means of wireless telegraphy. Taking into consideration the large orders the company will have to deal with, it will be quite impossible to carry these out without having sufficient credit, and, therefore, the board requests the shareholders to authorise it to have a credit, as and when required, up to 2,000,000 roubles.

Consolidated Electrical Co., Ltd.

THE directors' report for the year ended March 31st, 1914, states that the ordinary income for the period amounted to £4,786, in comparison with £6,004 for the previous year, the falling off being due to temporary loss of income consequent upon the change in the company's investments explained at the last general meeting. The general charges for the year amounted to £1,220, in comparison with £1,252 for the preceding twelve months. Of the balance of £8,242 standing to the credit of revenue account, the interim dividend of 3 per cent. paid on the preference shares on January 1st, 1914, absorbed £450, leaving a disposable balance of £7,792. The final dividend of 3 per cent. payable on the preference shares on 1st July will absorb a further £450, and the directors now recommend the payment of a dividend on the ordinary shares of 3¾ per cent. for the year. This will require £4,125 and leave £3,217 to be carried forward. The directors are satisfied that the valuation placed upon the company's investments in the balance sheet is within their intrinsic and realisable worth. It has become evident since the last general meeting that the feeling of the shareholders, with very few exceptions, is strongly favourable to the continuance of the company, and a scheme is under consideration for the re-arrangement of the capital account. In the meantime the funds of the company are profitably employed in realisable investments and short loans on securities.

The annual meeting was held on Monday, at River Plate House, Finsbury Circus, E.C., Mr. HERBERT ALLEN presiding.

In proposing the adoption of the above report the CHAIRMAN said that was the ninth distribution made by the company on its ordinary shares. In the aggregate those dividends had amounted to 31 per cent. of the nominal amount of the £1 shares, but on the actual cash paid by the shareholders the return had been 124 per cent., or an average of nearly 14 per cent. per annum. With regard to the operations of the past year the first thing that would strike their attention was the drop of £1,218 in the income from investments. The reason for that drop was that until the early part of last year they held over 72,000 shares in the Anglo-Portuguese Telephone Co. Just before the closing of the accounts on 31st March, 1913, they disposed of 70,000 of those shares for £87,500. Their income for the year was not affected by that sale because they stipulated with the buyers that they should receive the 1s. dividend just falling due, so that really they got 25s. each for the shares although nominally they passed at 24s. Out of the proceeds of that sale they paid off their loans and other liabilities and they were left with £70,000 to invest temporarily or otherwise as the case might be. Obviously they could not find safe and profitable investment for that money at five minutes' notice. Investments had to be found gradually, and for a time the greater part of their money lay on deposit at the bank at a very low rate of interest indeed, indeed some of it even now was not invested in the strict sense of the word, but was utilised to even greater advantage by being out on loan at remunerative rates to responsible parties and amply covered by collateral securities. To many of them it was no secret that the great trust companies, such as that company might become one day, employed as much of their capital as they possibly could in temporary loans, because the more frequently they turned over their money the better return they would get for it in the long run. At last in investments and loans they got all their money out and it was giving them an excellent return, combined with equally excellent security. Temporarily, they had suffered a loss in interest, but they were still paying the same rate of dividend, to maintain which they had only had to encroach upon their revenue balance to the extent of £1,425. He had no hesitation in saying that their financial position at the present time was better than it had ever been before. A year or so ago they had £85,000 worth of eggs all in one basket and they were not all marketable. They had outstanding against them loans of £15,000 which might possibly have been called in at an inconvenient moment. Those had since been got rid of and at the present time their loans and investments together amounted to nearly £75,000. They were spread over 20 or more entirely distinct channels and between investment and loaning their income was larger than it used to be. As to the nature of their business there had never been a moment when they could not have realised the whole of their investments at their full cost price or even more and they could do that at the present moment. As to the future of the company, at the last meeting some reference was made to a possible winding up and a distribution of

assets, and at that time he was inclined to think that that step was not far distant. Since then, however, they had taken some trouble to ascertain the general feeling of the shareholders on the subject and with the exception of about half a dozen gentlemen, the shareholders, generally speaking, were content with their investment as it was, particularly now that they had got rid of the old manufacturing business which was the undoing of the old company. Having satisfied themselves that the great majority of the shareholders were with them, nothing remained but for the board to bring forward a scheme of reconstruction and enlargement of the company. What they proposed was that the present £1 shares should be written down to 10s. each and that one new fully-paid £1 share be given for each two shares—in other words, the ordinary capital would be reduced from £110,000 to £55,000 and they would get rid of those fictitious assets which figured in the balance sheet. On the share capital so re-constituted they would be able to pay 7½ per cent. where they were now paying 3¾ per cent. The next step would be to enlarge the business of the company by the issue of further ordinary shares until the amount reached £100,000 or £150,000, possibly more. They might also issue a like amount of 5 per cent. preference stock or possibly a 4 per cent. stock. That, of course, was a matter that could not be decided upon at that meeting, and the board intended to convene a special general meeting in the autumn, when the whole scheme, together with the necessary resolutions, would be submitted for the consideration of the shareholders. With regard to the disposal of the Anglo-Portuguese Telephone shares, one reason they parted with them was that at the time the board of the Portuguese company—which had always been distinct from the board of that company, excepting that two of its five directors were also directors of the Consolidated Electrical—had decided against a bonus distribution from its reserve fund. With the sale of their 70,000 shares they parted with the control of the Portuguese company, and quite recently the board of that company had reversed its former policy and made a bonus distribution and also an issue of new shares. He was glad to say that they had been allowed to participate in that new issue to the extent of 10,000 shares at par, carrying dividend from 1st January last.

MR. RICHARD BARNETT seconded the motion.

Replying to shareholders, the CHAIRMAN said that on liquidation he estimated that the assets would produce about 10s. per share. Personally, he thought it would be a good thing to reconstruct, and he believed that was the view of the great majority of the shareholders. However, the full scheme, together with the necessary resolutions, would be sent out to all the shareholders and until they voted it was impossible to say which way the majority would vote.

The report was then adopted.

J. G. White & Co., Ltd.

MR. J. BEAVEN WHITE presided on Monday, at the Cannon Street Hotel, E.C., over the annual meeting of this company.

In moving the adoption of the report (ELEC. REV., Vol. 74, p. 1085), the CHAIRMAN said that the directors had referred to the depressed financial conditions now existing. These conditions had chiefly affected them in the following manners. First, they have not received new contracts as fast as they had been completing those in hand; and, secondly, they had been unable to follow as closely as they might wish the policy that the company had had since its inception, of keeping its position liquid, by the realisation of the securities taken in connection with contracts or where they had been assisting in financing new enterprises. The business had largely to do with the construction and development of hydro-electric enterprises, electric lighting and power development, electric tramways, railway and drainage works, and other public works. The most profitable field for these works had naturally been in countries where development had been rapid during the past few years, so that South America had been their principal field. In connection with these works, the present financial depression had made it difficult, if not impossible, to secure the necessary capital for the development of new enterprises, and in many cases had prevented the extension of established companies even where their earnings had been sufficient to place the security on a good investment basis. The works which they had in hand had been continued, and in this respect they had been fortunate. They had also been fortunate in securing some new contracts of importance, notwithstanding the conditions referred to. The Municipal and General Securities Co., Ltd., the capital of which it had been desirable to double, had continued to do a satisfactory financial business and had paid them a dividend of 10 per cent. per annum on its capital. The International Light and Power Co. owned a number of electric lighting and power undertakings in South America and also one in Yucatan, Mexico. All of the company's properties were making satisfactory progress, and it had been fortunate that the property in Mexico was in Yucatan, where there had been no disturbance, and therefore had been largely free of the difficulties that had occurred in other parts of Mexico, except for the effects of the fall in exchange. Their interest in this company was such that they had been financing its requirements until an issue could be made of the company's debentures. The earnings of the company's properties were at the present time at such a rate that the interest on the debentures was two-and-one-half times covered. From this they might judge as to the safety of the investment, and so soon as market conditions were satisfactory they would be able to realise the securities which they had taken, so as to provide them with the funds for taking up new enterprises and developing their business opportunities which would come with a return of more settled conditions. The enterprises in the Amazon Valley, with the management of which they were connected and in which they had a considerable interest, though representing less than 10 per cent. of their investments had had some set-back due to the general depression and to the rubber crisis. They had, however, considering all conditions, held their own as well as could be expected, and there was a growing opinion amongst those interested to the effect that the crisis might have reached its climax, and that conditions might shortly improve. The Amazon Valley was showing a resourcefulness that its best friends hardly anticipated, so that it was not impossible that it might emerge from its present trials with a new vigour and greater possibilities. The Building Construction Company had been finally liquidated by a distribution of certain of its investments which had been taken into their account and would be realised at an opportune time. The net profit for the past year had been £70,387. This was somewhat smaller than for the two preceding years, but under the circumstances they felt encouraged rather than discouraged by the result. This profit enabled them, after putting £15,000 to the general reserve account, to recommend dividends at the same rate as for the past three years, viz.: a total of 12 per cent. on the preference shares and 6⅔ per cent. on the ordinary shares of the company. Referring to the balance sheet the assets side showed that the cash and quick assets amounted to £145,597 as against £178,361 last year, a very moderate reduction under the circumstances. The item of "Works in progress" showed a large reduction, partially for the reasons already explained that the turnover in the construction department was less, but mainly because works in connection with the purchase and development of certain new electric lighting properties which were last year in the "Works in progress" item, this year appeared in the investment account. The investment account showed an increase from £163,728 to £420,257 for reasons previously explained. The dividends and interest from the securities held amounted to about 8 per cent. per annum on the book value, so that they might judge from these as to the conservative figure at which they had been valued. They would be disappointed if they did not realise very considerable profit when they were finally realised. With regard to the outlook for the year now current, he might say that they anticipated a further reduction in profits; at the same time, the amount of business in hand, although reduced, was still of considerable volume, and should be sufficient to bring the results for the year above rather than below the average which the company had shown since its inception. With regard to the resolution which they were asking the shareholders to pass with regard to the borrowing powers of the company, their articles now provided that the total amount borrowed at any time should not exceed the issued share capital of the company. At the time when the articles were drawn up in this way the issued share capital represented the total assets which the company had to deal with; in fact, it represented more than the tangible assets. The ordinary shares at that time represented goodwill to the extent of £47,000. They had now written off the goodwill account and accumulated surplus profits in the business equal in amount to the share capital, with the consequence that they were now able to do business on a larger scale than they were at the time the original articles were drafted, and there might be times when it was necessary in connection with the company's normal business temporarily to borrow amounts in excess of the share capital, and in asking them to give them borrowing powers equal to the share capital and reserves for the time being, they were merely asking to be reinstated in the position they were in when the original article was drawn.

MR. W. C. BURTON seconded the motion and the report was adopted without discussion.

The CHAIRMAN then proposed a resolution amending the articles of association so as to carry out the object he expressed in his speech.

The resolution was also carried without discussion.

Charles Churchill & Co., Ltd.—For the year ended March 31st last, the directors place to reserve £8,000, and propose a dividend of 20 per cent. (£10,000) on the ordinary shares, less £2,500 already paid by way of interim dividend; to distribute a bonus of 4s. 6d. per share on the ordinary shares; place an additional sum to reserve account of £8,000 and carry forward £4,629. —*Financial Times.*

Greenwood & Batley, Ltd.—The directors recommend dividends of 7 per cent. per annum on the preference and 5 per cent. on the ordinary shares for the year ended March, 1914. £8,000 is put to depreciation and £4,824 carried forward.

Japan.—The amount of fresh capital invested in the electrical and electricity supply industries in Japan during May last is returned at £385,000, of which £190,000 was for new undertakings, and £195,000 for the extension of old concerns.

Aluminium Corporation, Ltd.—At the recent annual general meeting it was determined not to hold the extraordinary meeting to pass resolutions varying the rights of the holders of the participating shares, in consequence of attention having been called to an ambiguity in the resolutions proposed to be submitted. The resolutions were recast so as to avoid the possibility of ambiguity, and notice of a fresh meeting on July 1st was issued. The secretary states that "the existing rights of the participating shares are the receipt of one-fifth of the whole profits of the company after payment of debenture interest, and, in the event of liquidation, to one-fifth of the assets of the company, after discharging liabilities to debenture-holders and other creditors. The modification of their rights as proposed will be to the advantage not only of the ordinary shareholders, but also, in a less degree, of the preference shareholders."

Trafford Power and Light Supply (1902), Ltd.—After charging debenture stock redemption fund and transferring to depreciation account £3,000, the accounts show a net profit for the past year of £4,846, as compared with £1,509 last year. The directors recommend a dividend of 5 per cent. on the preference shares. Terms were some months ago arranged with the Manchester Corporation for the purchase of the company's undertaking, but Parliament has disallowed the clauses relating to this purchase. "The directors consider it reasonable to anticipate that an offer to purchase may, in the near future, be received from one source or another."—*Financier.*

Rushden and District Electric Supply Co., Ltd.—Mr. F. H. Thornton, J.P., presided at the second annual meeting held at Northampton on June 24th. He said that, considering the short existence of the company, it had done very well. The number of consumers was now 57, and he hoped to see the manufacturers in the district avail themselves of electricity for power purposes. Mr. Brook Sampson seconded, and the report was adopted.

Imperial Tramways Co., Ltd.—Sir George White presided at the annual meeting held at Bristol on June 24th. He said that the general results of the business of the year could not be other than satisfactory to the shareholders. They were no longer under a cloud, and there were prospects of development in new directions.

Eastern Telegraph Co., Ltd.—A first quarterly interim dividend of 1¼ per cent. on the ordinary stock is announced.

STOCKS AND SHARES.

Tuesday Evening.

THE hot weather must be the excuse for the old joke that the principal rise has been in the thermometer. Markets before the heat-wave set in were inclined to lassitude and inertia, and with the fresh advance in the temperature, disinclination to deal in the Stock Exchange has become emphasised. At the same time, the observer will do well to notice the growing cheapness of money. This week's Consol settlement has been arranged on the basis of no more than 2 per cent.—nor can this light rate be ascribed to the preponderance of a bear party. Lombard Street authorities are almost unanimous in prophesying a long spell of pronounced ease in the money market, and this cannot fail of its effect, however much its influence may be checked by outpouring of new capital issues.

Consols have again started on the upward path, and rearrangement of investment quotations is general throughout all the Stock Exchange markets. The other day, for instance, half-a-score of Debenture stocks in the cable department were raised from ¼ to a point, though it is probable that in less than half the number did any stock change hands. The hardening tendency is curiously partial in its operation, for the Home Railway list—to quote one of the principal sections of the purely investment markets—exhibits scarcely any advances this week in its pre-ordinary securities. Again, in the case of electric supply Debenture stocks, while demand is insistent, quotations are allowed to remain at their current levels. Business, it may be thus inferred, is patchy. The fanatical murder of the Austrian Archduke last Sunday had no effect upon Stock Exchange prices.

Metropolitan Consolidated stock is ¼ higher at 39¾. Opposition from the North London Railway brought about the withdrawal of the Bill for the joint working of the Great Northern and City line by the Great Northern and the Metropolitan Railway Companies. This means, of course, that the plan for extending the tube to a proposed Lothbury station, and afterwards to the Bank, will also be abandoned—or, at all events, postponed. Echoes of the Swansea Conference continue to trouble the Home Railway market. At this season of the year, there should be at least some spark of animation in connection with the forthcoming dividend announcements; but Home Railway stocks are for the time being the fastest asleep of any issues in the Stock Exchange, and while this may be regarded as a high compliment to certain of the mining departments, it is, nevertheless, well deserved, so far as the railways are concerned. Districts went up with Metropolitans, and have retained part of this improvement, but in the other Undergrounds there are no changes worth mentioning.

The news from Mexico is of sufficient interest to keep attention on the *qui vive* for what may be the next development. During the past few days, rumours have insisted that the diplomatists at Niagara are practically agreed on some of the major points touching the questions of dispute; on the strength of this, many of the Mexican prices hardened, although, so far as the utility companies go, the movements are unimportant. Monterey Debenture is a point lower. Mexican Light & Power Preferred and First Mortgage bonds are both better. Brazilian Tractions, after touching 80½, reacted to 79. Shawinigan Water Capital stock lost part of its previous improvement, but the 4½ per cent. Debenture is amongst those to benefit by the demand for sound investment securities. Canadian General Common at 102½ is *ex* dividend. Calgary Power 1st Mortgage bonds have receded a trifle, and British Columbia Electric Railway issues are slightly lower.

Of the many dozen changes in our price lists over-leaf, by far the greater majority owe their movement to *ex* dividend markings. In some few cases deductions have been recovered, leaving the quotations unaltered on the week; and amongst these may be noticed Victoria Falls Preference, Western Telegraph shares, Commercial Cable Debenture and several others. The tendency throughout the markets is to lower prices by something less than the amount of the dividend, because it is found that the public buyer waits for the amount of the distribution to be taken off the price before sending in his orders. This is neutralised to some extent by the inclination—peculiar to most of us—not to sell until a security is quoted *ex* dividend, when the company's cheque may be retained without any reminder that it belongs to a purchaser. When markets are good, it probably pays the seller to wait for the quoting of the price *ex* dividend, though theoretically, of course, the deduction simply represents the amount of the dividend as near as possible.

The Constantinople Telephone Company notifies that no dividend will be paid for the half-year just ended, as authority to pay interest during construction ceased with the opening of the system on February 28th last. The president of the company, who has been to Constantinople, has returned with satisfactory reports, so dividends should be resumed in another six months or so. Meanwhile the price remains at 4¾ for the £5 fully-paid shares.

The excitement of the week has been furnished by lively dealings in Marconis. The legal cases now pending are thought in the Stock Exchange to be likely to have a prejudicial effect, inasmuch as they may serve to check ordinary buying of the shares; and on Tuesday morning a line was offered at 2¾. Although a subsequent recovery ensued, it was of small extent, and the prices are substantially lower on the week, both Ordinary and Preference showing a drop of ⅛. West India and Panama Telegraphs eased off to 30s., and the First Preference at 9 are 5s. down. Otherwise the list is generally firm, with small rises in a few of the principal Debenture stocks.

The Manufacturing group is inclined to harden. India-Rubber Preference, *ex* dividend, are 7s. 6d. better on the week, allowing for deduction of the 5s. just paid. Edison & Swan picked up to a couple of shillings. Aron Ordinary hardened to 16s. 3d. on the issue of the report. Brush Second Debenture at 33 *ex* dividend is in the proud position of returning 13 guineas per cent. on the money. The rubber share market plods along placidly. With the price of the produce keeping about 2s. 2¾d. per lb., there is no temptation for either investment or speculation to take a hand in the market, and so prices are what the newspapers call "marking time." Some of the rubber shares which used to be popular not very long ago, have become so passive that they are not dealt in from one week's end to another.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bath	June 24	5,055	+ 305	25	23,724	+ 1,747	..	..
Blackpool-Fleetw'd	,, 20	4,409	+1,611	24	12,939	+ 535	8	..
Bristol	,, 26	40,464	+6,919	26	209,480	+20,258	30·5	..
Brit. Elec. Trac. Co.	,, 19	241,434	+39,355	..	..	..	429·8	..
Chatham and Dist.	,, 18	3,878	— 30	24	21,361	+ 344	14·98	..
Cork	,, 25	2,183	+ 23	25	12,235	+ 248	9·89	..
Dublin	,, 19	25,486	—1,028	25	137,162	— 3,696	54·25	..
Hastings	,, 24	4,575	+ 547	25	..	+ 303	19·3	..
Lancashire United	,, 24	7,023	+ 864	25	41,087	+ 4,657	42	·3
Llandudno-Col. Bay	,, 19	1,753	+ 506	29	6,493	+ 49	6·5	..
London United ..	,, 19	28,286	— 465	25	14,902	+ 2,751	..	..
Tyneside	,, 17	2,353	+ 189	24	12,814	+ 816	11	..
Anglo-Argentine ..	,, 24	123,708	+ 865	25	1,405,980	+ 7,851	..	..
Auckland	,, 5	20,919	+ 912	48	247,511	+ 6,331	25·42	1·03
Calcutta	,, 27	173,647	+1,815	..	..	+ 6,465	..	..
Kalgoorlie, W.A. ..	May	3,025	..	23	12,880	..	20·5	..
Madras	June 15	3,718	+ 205	23	21,199	+ 1,691	15·25	..
Montevideo ..	May	29,016	— 815	30	229,192	— 401	..	..
Cen. London Rly.	June 20	19,458	+1,178	25	125,868	— 2,593	6·78	·4
City & S. Lon. Rly.	,, 20	10,290	+ 83	25	67,765	— 4,230	7·26	..
Dublin-Lucan Rly.	,, 19	497	+ 63	24	3,271	— 20	7	..
L'pool Overh'd Rly.	,, 21	7,293	+ 289	25	42,659	+ 1,534	6·6	..
London Elec. Ry. Co.	,, 20	54,675	+2,755	25	855,860	+ 2,775	21·25	..
Mersey Railway ..	,, 20	9,068	+ 328	25	56,420	+ 368	4·5	3·5
Metropolitan Rly.	,, 21	78,260	+7,843	25	454,296	+39,435	29·25	..
Met. District Rly.	,, 20	53,009	+ 764	25	328,924	+ 1,074	25	..

SHARE LIST OF ELECTRICAL COMPANIES.

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1912.	Dividends for 1913.	Closing Quotations June 30th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	..	7/16 — 1/2	..	Nil
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	70 — 75	..	6 0 0
Brit. Elec. Trac., 6 % Pref.	100	..	..	13½ — 15½	..	..
Do. Do. Deferred	100	..	..	6 — 8	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	85 — 89 xd	..	6 11 2
Do. 7 % Non-Cum. Pr'f.	100	3	3½	53 — 56 xd	..	5 18 8
Do. 5 % Perp. Deb.	100	5	5	92 — 94	— ½	5 6 5
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 80	..	5 12 9
Central London Railway, Ord.	100	3	3	57 — 62	..	4 16 9
Do. Gtd. Assented	100	..	4	82 — 84	..	4 15 3
Do. Pref.	100	4	4	68 — 73	..	5 9 7
Do. Gtd. Assented	100	..	4	84 — 86	..	4 18 0
Do. Def.	100	2	2	40 — 45	..	4 9 0
Do. Gtd. Assented	100	..	4	80 — 82	..	4 17 7
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
City & S. London, 5 % Pref., 1891	100	5	5	95 — 97	..	5 3 1
Do. Do. 1896	100	5	5	91 — 94	..	5 6 5
Do. Do. 1901	100	5	5	89 — 92	..	5 8 8
Do. Do. 1908	100	5	5	89 — 92	..	5 8 8
Do. 4 % Deb.	100	4	4	86 — 88	..	4 11 0
Hastings Trams, 6 % Pref.	1	6	6†	15/16 — 1 1/16	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	65 — 70	..	6 8 7
Isle of Thanet Trams, 5 % Pref.	5	2½	3	2 — 2½	..	6 0 0
Do. 4 % Deb.	100	4	4	71 — 76 xd	..	5 2 7
Lancashire United, 5 % Deb.	100	5	5	84½ — 86½ xd	..	5 15 4
London and Suburban, Ord.	1	..	..	1/16 — 3/16	..	..
Do. Do. 5 % Cum. Pref.	1	..	5†	1/16 — 3/16	— 1/16	8 0 0
Do. Do. 4½ % 1st Deb.	100	4½	4½	74 — 79 xd	— 1½	5 14 0
London Elec. Railways, 4 % Deb.	100	4	4	88 — 90 xd	..	4 9 0
London United Trams, 4 % Deb.	100	4	4	54 — 58 xd	..	6 18 0
Metropolitan Railway Consol.	100	18	18	39½ — 40	+ ½	4 12 10
Do. Surplus Lands	100	2½	2½	59 — 61	..	4 10 4
Do. 3½ % Deb.	100	3½	3½	87 — 89	..	3 18 7
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	79 — 81	..	4 6 4
Metropolitan District Ord.	100	Nil	..	24½ — 24⅝	+ ⅛	Nil
Do. 6 % Deb.	100	6	6	186 —189 xd	..	4 6 0
Do. 4 % Deb.	100	4	4	91 — 93 xd	..	4 6 0
Do. 4 % Prior Lien	100	4	4	95 — 97	..	4 2 6
Do. 4½ % First Pref.	100	4½	4½	83 — 86	..	5 4 8
Do. 3½ % Gtd.	100	3½	3½	74 — 76	..	4 12 1
Metro. Elec. Trams, 4½ % Deb.	100	4½	4½	85 — 88 xd	..	5 2 3
Do. 5 % Deb.	100	5	5	85½ — 88½	..	5 13 0
Potteries, Ord.	1	3½	3½	9/16 — 11/16	..	8 12 10
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	7 12 8
Do. 4½ % Deb.	100	4½	4½	81½ — 84½	..	5 6 2
South Metro. Trams, 4 % Deb.	100	4	4	64 — 68 xd	..	5 17 8
Underground Elec. Railways	10	..	..	8½ — 8¾	..	Nil
Do. "A"	1/-	..	..	1/16 — 3/16	..	Nil
Do. 6 % First Cum. Inc. Deb.	100	6	6	115 —117	..	5 2 7
Do. 4½ % Bonds	100	4½	4½	100 —102	..	4 8 2
Do. 6 % Income	100	6	6	90 — 91	..	6 11 10
Yorkshire (West Riding), Ord.	5	Nil	Nil	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	3	4	4 — 4½	— ⅛	4 9 0
Do. 4½ % Deb.	100	4½	4½	83 — 86 xd	..	5 4 8

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4 13/16 — 4 15/16 xd	..	5 17 5
Do. 2nd Pref.	5	5½	5½	4½ — 4⅝ xd	+ 1/16	6 2 3
Do. 4 % Deb.	100	4	4	91 — 93 xd	..	4 6 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
Do. 5 % Deb.	100	5	5	94½ — 96⅞	..	5 3 6
Auckland Trams, 5 % Deb.	100	5	5	101 —104 xd	..	4 16 8
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11⅝	..	5 2 2
Do. 4½ % Deb.	100	4½	4½	94 — 96 xd	+ 1½	4 18 9
Do. 5 % 2nd Deb.	100	5	5	100 —102	..	4 18 0
Brazilian Traction, Light and Power	$100	6	6†	78 — 80	— ½	7 10 0
Brisbane Trams Invt., Ord.	5	8	8	6⅞ — 7⅛	..	5 8 3
Do. 5 % Pref.	5	5	5	4⅜ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	98 —100 xd	..	4 10 0
B. Columbia Elec. Rly., Def.	100	8	8†	108 —112	—1	7 2 8
Do. Pref. Ord.	100	6	6	103 —107	..	5 12 1
Do. 5 % Pref.	100	5	5	105 —108	+1	4 12 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98 —101	..	4 9 0
Do. 4½ % Vancouver Deb.	100	4½	4½	94 — 98	..	4 12 0
Do. 4½ % Con. Deb.	100	4½	4½	95½ — 97½	+ ½	4 7 2
Calcutta Trams, Ord.	5	7½	9¼	6⅜ — 7	..	6 15 9
Do. 5 % Pref.	5	5	5	4⅜ — 5 xd	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 99 xd	..	4 11 0
Cape Electric Trams	1	5	5	7/8 — 15/16	..	6 18 4
City Buenos Aires Trams (1904)	5	5	5	5 31/32 — 5 63/64	..	4 11 11
Do. 4 % Deb.	100	4	4	95 — 100 xd	+4	4 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	91 — 95	..	5 5 3
Havana Elec. Rly., 5 % Bonds	$1000	5	5	93½ — 97½	..	5 2 6
Kalgoorlie El. Trams 5% A Deb.	100	5	5	82 — 87	..	5 15 0
Do. 6% B Deb.	100	8	..	10 — 20	..	Nil
La Plata Elec. Trams, Ord.	1	..	..	1/16 — 1/8	..	..
Do. Pref.	1	4½d.	6	3/16 — 1/4	..	6 5 0
Lisbon Elec. Trams, Ord.	1	6	6	1 3/16 — 1 1/4	..	4 9 3
Do. 6 % Pref.	1	6	6	1 3/16 — 1 5/16 xd	..	5 3 8
Do. 5 % Deb.	100	5	5	95 —100	..	5 0 0
Madras Elec. Tr., 6% Cum. Pref.	5	6	6	4⅞ — 5⅛	..	5 14 3
" Elec. Tr. (1904), Deb.	100	5	5	98 —101 xd	+1	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	78 — 81	..	6 8 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½ —100½	..	4 19 6
Mexico Trams Com	$100	7	7	72 — 76	..	..
Do. Gen. Con. 5 % Bonds	..	5	5	80 — 84	..	5 19 1
Do. 6 % Bonds	100	6	6	77 — 81	..	7 8 2
Para Elec. Rlys. & Lt., Ord.	5	10	10	4 — 4½	..	11 2 2
Do. 6 % Pref.	5	6	6	4 — 4½	..	6 13 4
Do. 5 % 1st Deb.	100	5	5	87½ — 90½	+1	5 10 8
Rangoon El. Tr. & Sup., Pref.	5	6	6	4⅞ — 5⅛ xd	..	5 11 7
Do. 4½ % 1st Deb.	100	4½	4½	94 — 96 xd	+1	4 13 9
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	100 —102	..	4 18 0
Do. 5 % Mort. Bonds	100	5	5	90 — 92	..	5 8 8
Sao Paulo Tram., Lt. and P. 5 % 1st Deb.	$500	5	5	97 —101	+1	4 19 0
Singapore Trams, 5 % Deb.	100	5	5	88 — 92	..	5 8 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95 — 97	..	5 3 0
Un. Elec. Trams Monte Video	5	7	7	4⅛ — 5 xd	..	7 0 0
Do. 6 % Pref.	5	6	6	4⅜ — 5⅛ xd	..	5 17 8
Do. 5 % 1st Deb.	100	5	5	92½ — 96½	+1½	5 3 8
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	93½ — 95½	..	4 14 8

ELECTRICITY SUPPLY AND POWER COMPANIES.—HOME.

Bournemouth & Poole, Ord.	10	6	7	10 — 11	..	6 7 4
Do. 4½ % Pref.	10	4½	4½	9⅜ — 10⅛	..	4 5 9
Do. Second 6 % Pref.	10	6	6	10⅛ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	93 — 96 xd	..	4 13 9
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅛	..	5 8 1
Do. 7 % Cum. Pref.	5	7	7	8⅛ — 8⅜	..	4 0 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	89½ — 92½	..	4 6 8
Charing Cross, West End & City	5	5	6	4⅜ — 5⅛	..	5 14 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	4 3/16 — 4 7/16 xd	..	5 1 5
Do. Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Chelsea, Ord.	5	5	5	4⅛ — 5	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	95 — 98 xd	..	4 11 0
City of London, Ord.	10	9	10	16½ — 17½	..	5 16 0
Do. 6 % Cum. Pref.	10	6	6	12½ — 13½	..	4 7 3
Do. 5 % Deb.	Stock	5	5	115 —118 xd	..	4 4 9
Do. 4½ % Second Deb.	100	4½	4½	98 —101 xd	..	4 9 1
County of London, Ord.	10	6	7	11½ — 12½	..	5 14 3
Do. 6 % Pref.	10	6	6	11½ — 12½	..	4 18 0
Do. 4½ % Deb.	Stock	4½	4½	101 —104 xd	..	4 6 7
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 1
Edmundson's, Ord.	£3	..	..	5/16 — 7/16	..	Nil
Do. 6 % Cum. Pref.	5	6	6	3⅞ — 4	..	7 10 0
Do. 6 % Non-Cum. Pref.	5	..	..	1⅜ — 2	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	83 — 86	..	5 4 6
Folkestone	5	6	6	5 — 5⅜	..	5 9 1
Do. 4½ % First Deb.	100	4½	4½	93 — 95	..	4 14 9
Hove	5	8	9	8⅜ — 9	..	5 0 0
Kensington & Knightsbridge, Ord.	5	8	9	7⅜ — 7⅞	..	5 14 8
Do. 4 % Deb.	Stock	4	4	90 — 92	..	4 7 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 0
London Electric, Ord.	3	2½	3	1⅛ — 1⅜	..	5 10 7
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 14 8
Do. 4 % First Mort. Deb.	Stock	4	4	91 — 94	..	4 5 1
Metropolitan	5	4½	4½	8½ — 8⅝	— ⅛	6 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½ xd	— ⅛	4 10 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	96 — 99 xd	..	4 11 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	82 — 84 xd	..	4 3 4
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	98 —101	..	4 19 1
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9¼ — 10½ xd	..	5 17 3
Oxford	5	7	7	5⅞ — 6⅛	..	5 10 0
St. James' and Pall Mall, Ord.	5	10	12	9½ — 9⅝	..	6 3 1
Do. 7 % Pref.	5	7	7	6⅞ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	82 — 86 xd	..	4 2 4
South London, Ord.	4	5½	5½	2⅜ — 3½	..	6 10 4
Do. 5 % First Mort. Deb.	100	5	5	97 —100 xd	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅝	..	5 6 8
Do. 4½ % First Deb. Stock	100	4½	4½	97 — 100	..	4 10 0
Urban, Ord.	£3	Nil	..	5/16 — 7/16	..	..
Do. 5 % Cum Pref.	5	3†	4	2⅜ — 3	..	6 13 4
Do. 4½ % First Mort. Deb.	100	4½	4½	84 — 87	+1	5 3 8
Westminster, Ord.	5	10	10	8⅜ — 8⅞	..	5 12 8
Do. 4½ % Cum Pref.	5	4½	4½	4 15/16 — 5 1/16 xd	+ 1/16	4 6 9

* Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ And Bonded Certs.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICITY SUPPLY AND POWER—COLONIAL AND FOREIGN.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 30th.	Rise + or Fall —	Present Yield p.c.
Adelaide, 6 % Pref.	£	6	6	5⅛ – 5⅜	..	5 11 7
Calcutta, Ord.	£	8½	9	7½ – 7⅝	..	5 18 0
Do. 5 % Pref.	£	5	5	5 – 5⅛	..	4 14 1
Calgary Power, 1st Mort. Bds.	100	5	5	89½ – 91½	–1	5 9 3
Canadian Gen. El. Com.	$100	7	8	100 – 105 xd	..	7 12 6
Do. 7 % Pref.	$100	7	7	118 – 123	..	5 13 10
Cordoba Lt., Power and T., Ord.	£	5	..	⅞ – 1	..	7 12 0
Do. 5 % Deb.	100	5	5	80 – 85	..	5 17 8
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	81 – 83 xd	..	6 19 6
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	5	94 – 97 xd	+ 6½	5 3 1
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93½ – 95½	..	5 4 9
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅜ – ⅝	..	Nil
Do. 6 % Pref.	£	6	4	⅛ – ⅜	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101 – 104	..	4 16 2
Madras, Ord.	£	Nil	..	1½ – 1⅞	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	103 – 106 xd	..	4 14 6
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	61 – 66	..	7 11 6
Mexican Lt. & Power, Common	$100	4	4†	45 – 48	..	..
Do. 7 % Cum. Pref.	$100	7	7	73 – 77	+1½	9 4 10
Do. 5 % 1st Mort. Gold Bds.	..	5	5	75 – 80	+1	6 5 0
Do. 5 % 2nd Mort. Bonds	100	5	5	59 – 64	..	7 13 8
Monterey Rly., Light & Power, 5 % 1st Mort. Deb.	* 100	1912. 5	1913. 5	50 – 54	–1	£ s. d. ..
Montreal, Lt., Power and Coal, 5 % 1st Mort. Bonds	$100	9	10†	220 – 235	..	4 5 1
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5a	5a	10 – 20	..	..
River Plate, Ord.	Stock	10	10	235 – 245	..	4 1 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	97 – 103	..	5 16 6
Do. 5 % Deb. Stock	Do.	5	5	99 – 101 xd	..	4 19 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 – 102	..	4 8 3
Shawinigan Water, Capital	$100	5½	6	133 – 137	–2	4 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 – 109	..	4 11 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100 – 102	+ ½	4 8 8
Toronto Power, 4½ % 1st Deb.	Do.	4½	4½	97 – 99	+1	4 11 0
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	85 – 87	..	5 15 0
Victoria Falls Power, Pref.	1	6	6	11/16 – 3/4 xd	–1/32	8 0 0
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103 105	..	5 14 3

MANUFACTURING COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 30th.	Rise + or Fall —	Present Yield p.c.
Aron, Ord.	£	1	7	7	3/8 – 7/16	+1/16	8 0 0
Do. 6 % Pref.	£	1	6	6	3/8 – 1/2	..	6 17 2
Babcock & Wilcox	£	1	16	16	2¾ – 3	..	5 6 8
Do. Pref.	£	1	6	6	1⅝ – 1⅞	..	4 7 6
British Aluminium, Ord.	£	1	..	5	1⅝ – 1¾	..	4 14 1
Do. 6 % Cum. Pref.	£	1	6	6	25/32 – 13/16	..	6 9 0
Do. 5 % Prior Liens Debs.	£	100	5	5	97 – 100	..	5 0 0
Do. Deb. Stk.	£	100	5	5	90 – 95	..	5 5 3
B.I. & Helsby Cables	£	5	10	13	9⅜ – 9⅞	..	6 11 8
Do. Pref.	£	5	6	6	5⅝ – 6⅛	..	4 14 1
Do. Deb.	£	100	4½	4½	100 – 103 xd	+1/2	4 7 5
British Thomson-Houston, Deb.	£	100	4½	4½	92 – 94	..	4 15 9
British Westinghouse, Pref.	£	2	Nil	5	1⅜ – 1⅞	..	5 6 8
Do. Deb.	£	100	4	4	72 – 75 xd	+ ½	5 6 8
Do. 6 % Prior Lien	£	100	6	6	101 – 104	..	5 16 6
Browett, Lindley, Ord.	£	1	..	..	8/- – 8/-	..	Nil
Do. Pref.	£	1	..	..	8/- – 8/6	..	Nil
Brush, 7 % Pref.	£	½	Nil	..	0 – ½	..	Nil
Do. 5 % Prior Lien Deb.	£	100	5	5	80 – 85 xd	..	5 17 8
Do. 4½ % Deb.	£	100	4½	4½	52 – 57	..	7 17 10
Do. 4½ % Second Deb.	£	100	4½	4½	29 – 33 xd	..	13 12 8
Callender's Cable	£	5	15	15	11⅜ – 12⅜	..	6 3 8
Do. Pref.	£	5	5	5	5 – 5⅛ xd	..	4 15 3
Do. Deb.	£	100	4½	4½	97 – 100 xd	+2½	4 10 0
Castner-Kellner	£	1	20	22½	2⅞ – 2 1/16	–1/16	8 15 5
Do. Deb.	£	100	4½	4½	104 – 107	..	4 4 1

TELEGRAPH AND TELEPHONE COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 30th.	Rise + or Fall —	Present Yield p.c.
Amazon Telegraph	£	10	4½	4½	5⅜ – 6½	..	7 4 0
Do. 5 % Deb. Red.	£	Stock	5	5	96 – 99	+1	5 1 0
American Telep. & Teleg., Cap.	$	$100	8	8	122 – 126 xd	..	6 7 0
Do. Collat. Trust	$	$1000	4	4	92 – 95	..	4 4 3
Anglo-American Telegraph	£	Stock	8	8	64 – 67	..	4 9 7
Do. 6 % Pref.	£	Do.	6	6	107½ – 108½	..	5 10 7
Do. Def.	£	Do.	80/-	80/-	22⅝ – 23½	..	6 9 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	£	100	5	5	102 – 104	..	4 16 2
Chili Telephone	£	5	8	6†	7⅛ – 7⅜	..	5 6 8
Commercial Cable, Stlg. 4 % Deb.	£	Stock	4	4	79 – 81 xd	+2	4 18 9
Cuba Telegraph	£	10	6	6†	8 – 9	..	6 13 4
Do. 10 % Pref.	£	10	10	10	16 – 17	..	5 17 8
Direct Spanish Telegraph, Ord.	£	5	4	4	8¼ – 4	..	5 0 0
Do. 10 % Cum. Pref.	£	5	10	10	7½ – 7⅞	..	6 9 0
Direct United States Cable	£	10	4	4	6⅜ – 6⅝	..	5 16 4
Direct W. India Cable, 4½ % Reg. Deb.	£	100	4½	4½	98 – 100	..	4 10 0
Eastern Telegraph, Ord. Stock	£	Stock	7	7	129 – 132	..	5 6 3
Do. 8½ % Pref. Stock	£	Do.	8½	8½	76 – 78	–1	4 9 9
Do. 4 % Mort. Deb.	£	Do.	4	4	95 – 97	+ ½	4 2 6
Eastern Extension	£	10	7	7	12⅝ – 13	..	5 7 9
Do. 4 % Deb.	£	Stock	4	4	95⅛ – 97⅛	+ ⅛	4 2 1
Globe Telegraph and Trust	£	10	6	6†	10⅜ – 11½ xd	..	5 6 8
Do. 6 % Pref.	£	10	6	6	12½ – 12⅝ xd	..	4 14 1
Great Northern Telegraph	£	10	20	20	31½ – 32½	..	5 19 5
Indo-European Telegraph	£	25	13	13	56½ – 58½	..	5 11 1
Mackay Companies Common	$	$100	5	5	80 – 85	..	5 17 8
Do. 4 % Cum. Pref.	$	$100	4	4	67 – 72	..	5 11 1
Marconi's Wireless Telegraph	£	1	20	20	2 1/16 – 2 1/8	– 1/16	7 2 4
Do. 7 % Cum. Partic. Pref.	£	1	17	..	2⅛ – 2⅜	– 1/16	7 8 2
Monte Video Telephone, Ord.	£	1	6	6	1⅛ – 1⅜	..	6 8 0
Do. 5 % Pref.	£	1	5	5	1⅜ – 1⅝	..	5 18 6
New York Telep., 4½ % Gen. Bnds.	$	100	4½	4½	100½ – 101½	+ ½	4 9 0
Oriental Telep. and Elec.	£	1	10	10	2⅛ – 2⅜	..	4 7 6
Do. 6 % Cum. Pref.	£	1	6	6	1⅝ – 1⅞	..	4 18 5
Do. 4 % Red. Deb.	£	Stock	4	4	86 – 88 xd	..	4 11 0
Pacific and European Tel., 4 % Guar. Debs.	£	Do.	4	4	96 – 98 xd	..	4 1 8
Reuter's	£	10	10	7	7½ – 8½	..	8 4 8
Submarine Cables Trust	£	Cert.	6	6	126 – 129	..	4 18 7
Telephone Co. of Egypt, 4½ % Deb. Red.	£	Stock	4½	4½	97 – 99	–1	4 11 0
United River Plate Telephone	£	5	8	6†	6½ – 6⅝	..	5 18 5
Do. 5 % Cum. Pref.	£	5	5	5	5 – 5½ xd	..	4 11 0
West Coast of America	£	2½	2½	N	⅞ – 1⅛	..	Nil
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	£	100	4	4	97 – 100	+1	4 0 0
West India and Panama Teleg.	£	10	1½	1½	1⅜ – 1⅝	–1/16	7 13 10
Do. 6 % Cum. 1st Pref.	£	10	6	6	8½ – 9½	– ½	6 9 9
Do. 6 % Cum. 2nd Pref	£	10	6	6	8¼ – 8⅝	+2/8	6 16 9
Do. 5 % Debs.	£	100	5	5	98 – 100 xd	+1	5 0 0
Western Telegraph, Ltd.	£	10	7	7	18½ – 18⅝ xd	+ ⅛	5 1 11
Do. 4 % Debs.	£	Stock	4	4	95 – 97 xd	..	4 2 8
Western Union 4½ % Fdg. Bonds	$	$1000	4½	4½	94 – 97	..	4 12 9

* Unless otherwise stated all shares are fully paid. † Interim dividend. a Paid in deferred interest warrants.

Bank rate of Discount 3 per cent., January 29th, 1914.

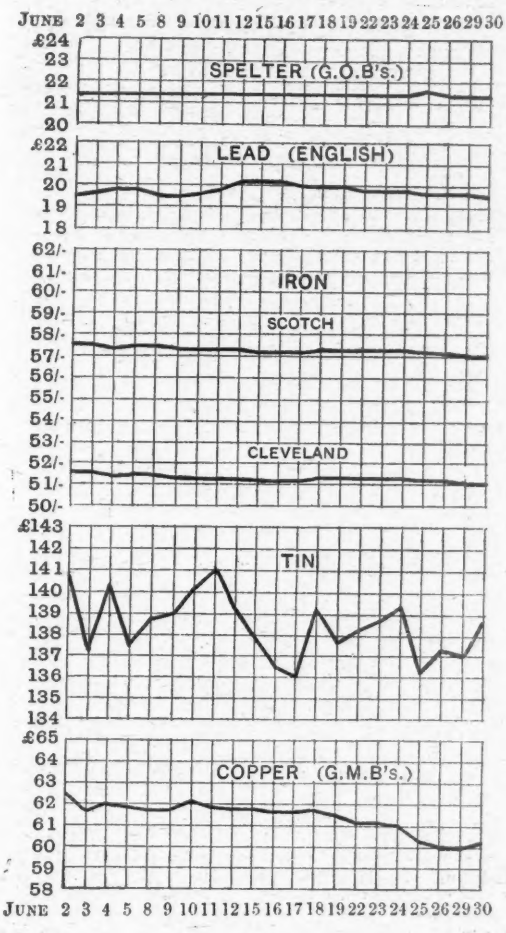
Electric Cooking on the U.S.S. "Texas."—A recent issue of the *Electrical World* contains particulars of the extensive electric cooking equipment on the U.S. battleship *Texas*, which only left the Brooklyn Navy Yard in May last. Coal-fired ranges have been entirely replaced by 10 electric ranges in the general mess galley and five in the officers' galley, also two bakers' ovens. The officers and crew number 970, and about 6,300 lb. of bread per week are required, exclusive of the officers' requirements. All the boiled food for the men is prepared in steam-jacketed cauldrons (non-electric), but for the officers electricity is used exclusively for all cooking. In the crew's galley eight-plate ranges equipped with broilers and ovens are installed. Leaf elements are used in hot-plates—four connected in two series groups per plate; the broiler elements, of exposed spirally wound resistance wire, are stretched across the top of the compartment, and supported at intervals, and the oven units are similarly arranged at both top and bottom of the compartments. Extra "quick-heating" elements are also provided for rapid oven heating. The switches are arranged at the back over the hot-plates. A main switch and fuses are fitted with 10 knife switches, one for each heater on the range. The hot-plate and oven switches have each an auxiliary blade, to energise the extra-heat unit for rapid heating.

The two bakery ovens have each six baking levels and control switches on one side for the heaters placed at the top and bottom of each pair of baking levels. The heaters are similar to those in the range ovens. The apparatus installed allows of one-fifth being idle each week. The cooking staff greatly favour the electric cooking apparatus, which has been in constant use since March last.

The I.M.E.A. Bill.—On Tuesday last this Bill, for giving increased powers to the municipal authorities with reference to electricity supply, was introduced by Sir Howell Davies and read a first time.

METAL MARKET.

Fluctuations in June.



Gas.—Our friend the *Gas World*, with admirable candour, discusses the Carpenter system of purification of coal-gas, which reduces the sulphur content to the "almost inappreciable minimum," and remarks: "The ultimate arbiter in the case of gas burned for lighting, the human nose, remains as active and as powerful as ever. Some persons' sense of smell is far more acute than that of the majority. There may be grounds for the opinion of certain physiologists that this sense is being gradually lost by civilised people, except for the strongest odours. The point is, however, that to many the odour of burned gas is very noticeable and equally offensive. The question is, will the reduction of sulphur claimed by Dr. Carpenter remove this objection? Or is it worth considering at all, in the actual and prospective state of the gas industry?"

The complete removal of the sulphur would remove one of the most serious objections to the use of gas; and we regret that our contemporary leaves the matter in the form of a question, and does not plump solid for amendment. But what we would ask is how the fact that "the odour of burned gas is very noticeable" squares with the teachings of Prof. Lewes, that the products of combustion go up through the ceiling and thus draw in fresh air? What becomes of the unparalleled efficiency of gas as a ventilating agent? Or is it in the room above that ceiling, blackened with the remains of innumerable microbes, that "the odour of burned gas is very noticeable?"

New Radiations.—In an address to the members of the Physical Society who visited the Cavendish Laboratory recently, the President, Prof. Sir J. J. Thomson, described experiments which had been conducted in that laboratory with a view to filling up the gap between the red light radiation and the shortest known electrical waves. No radiation due to the impact of positively charged atoms had previously been detected, but by using the exceedingly sensitive Schuman photographic plates, they had succeeded in obtaining unmistakable evidence that they gave out a type of Röntgen radiation with a Crookes tube. A second method, using an ordinary Röntgen-ray tube, was under investigation. Sir Oliver Lodge, in moving a vote of thanks, welcomed the important discovery as an event of considerable magnitude.

THE MUNICIPAL ELECTRICAL CONVENTION.

(*Continued from Vol. 74, page 1095.*)

The Standardisation of Tariffs.

(Abstract of paper by J. HORACE BOWDEN, Chief Electrical Engineer, Poplar.)

IN the author's opinion the primary object of a municipal supply of electricity is the universal use of energy for power, light and heat at the lowest possible cost to the consumer, compatible with efficient service.

The secondary object is the concentration of fuel combustion in a given area, and at that centre the obtaining of efficient combustion.

The question of relief of rates is a controversial one. The author contends that it should only be incumbent upon the undertaking to make good any contributions that may have been received from the rates, providing that all public services are rendered on an absolute cost basis.

If it is recognised in the policy of an undertaking that the supply is established for the benefit of all ratepayers, there is no logical reason for restricting the progress of the supply by imposing charges higher than are necessary to cover actual expenditure.

If it were possible to so arrange tariffs as to produce an income exactly equivalent to expenditure, such tariffs, if conceived on an equitable basis, would undoubtedly be ideal.

The question of acquisition of an asset producing revenue free from debt should be at once dismissed from the minds of all councillors so that the present capital restrictions may be readily removed.

No one can conceive of the enormous impetus that will be given to the electrical industry during the next few years if the management is untrammelled by false capital restrictions.

The author does not advocate the borrowing of money to supply cooking and heating appliances on hire; provision should be made out of revenue for any expenditure that may be necessary in this direction.

The L.G.B. now allows periods from twenty-five to fifteen years for the repayment of loans on account of mains, and the London County Council has fixed the maximum period at twenty-five years. Twelve and ten years are considered suitable periods for services and meters respectively.

The law of continuity of supply renders it imperative that mains, services and meters shall always be kept in a perfect state of efficiency, and there does not appear to be any valid reason why the extreme limit allowed by law for repayment of the loans for these purposes should not be granted, namely, sixty years.

Loans in perpetuity for these purposes and for land might very reasonably be advocated, excepting for the remote possibility that at some future date electricity supply may be superseded by some as yet undiscovered power.

Buildings and machinery are not governed by the same law as the means of distribution. It can never be anticipated that engineering science will stand still, and there must be a succession of replacements for many years to come.

These are matters for consideration at the hands of electricity committees which must be well defined before the responsible manager can attempt to evolve an equitable tariff.

The author submits, without fear of contradiction, that any system by which a return to the undertaking could be made by each consumer of the exact cost entailed by the demand of each consumer, would be ideal.

While it may be true that the laws of expediency govern private enterprise, it should never be lost sight of that municipal enterprise is governed by the laws of equity.

No argument, however specious, will alter the fact that it is inequitable to supply to one class of consumer at a loss which is to be recouped from another class.

The future practice in electricity supply is undoubtedly that which will enable an authority to assess an annual charge for declared requirements, irrespective of the purpose to which power may be applied or to the extent that such power may be used.

There is a possibility in the near future that running costs will be entirely eliminated by the sale of by-products; until then a secondary charge remains essential, and it is in the interests of all concerned to standardize such charge, and for this purpose the Association known as the "Point Fives" came into being.

The charge of 0.5d. per unit carries with it, in modern undertakings, a sufficient margin over and above running cost to allow for fluctuations in price of coal, and provision against all contingencies such as breakdown of electrical machinery and failure of distributing and feeder cables.

The practice which called the Point Five Association into being is undoubtedly a mere stop-gap, but the opportunity should now be taken of using this means to obtain the ultimate end in establishing a system that can be applied universally to all classes of supply.

Some undertakers have considered it expedient to apply only the secondary charge for domestic purposes. Others, again, have considered it expedient to impose the primary charge on one class of supply only, viz: lighting, and to apply the secondary charge to all other uses. It does not require great reasoning powers to foresee that a policy of this sort is of a transient nature.

Many undertakers have adopted the rateable value system for assessing a primary charge; but no more pernicious system has ever been introduced into electricity practice. Tenants in houses similarly assessed may make most divergent demands upon the resources of an undertaking.

The assessment on dwellings at and under £20 per annum is generally much lower than the better class, due to compounding by the landlords, yet this class of tenant will make a greater demand in proportion to rateable value.

In the Poplar area there are 3,259 houses rated over £20 per annum, and the author estimates that an average use of energy could be made by each tenant of 3,000 units per annum under present conditions of supply, which would be materially increased if the secondary charge were to be eliminated. But there are 19,866 houses rated at and under £20 each, having a prospective use of 1,000 units per annum under present conditions. The field for exploitation in the first instance is only 10,000,000 units per annum, whereas in the second instance it is about double, therefore the working class of supply demands equal consideration with the genteel class. But when the case of the shop-keeping class is considered, there does not appear to be any justification for the system.

The assessment of licensed premises is generally considerably greater than other business premises making a similar demand for light.

It appears to be a curious fact that the only equitable application of the rateable value system would act as a deterrent to the adoption of electricity because, as a natural sequence to the installation of, say, an additional 100 H.P. motor, the electricity department would apply to the rating department to make an increased assessment on the property of that particular consumer.

But apart from the inherent impracticability of rateable value as the basis of fixing a charge for universal supply, there is the objection of handing over to another department the onus of fixing the primary charge for electricity.

It is the diversity in the use of energy that imposes upon supply authorities the necessity to adopt a form of assessment as the primary charge, and if it can be shown to be practicable to establish a tariff on an equitable basis applicable to the demands of any area, it is equally practical to standardize a system that is applicable to all areas.

The accepted definition of the diversity factory in a supply of electrical energy is "the result of the sum of the consumers' maximum demands, divided by the combined maximum demand upon the system."

There is apparently no reason why every consumer should not utilize the service to such an extent as to make a return in full, as nearly as may be, to the undertakers, of the cost of such service.

This can best be done by studying the conditions of *each class of supply in each individual area upon its own merits*, and estimating the relationship of the demand for each class to the actual maximum demand upon the system.

Assumption and experience must, to a large extent, control these estimates. In Poplar, which is an industrial area, the following scale has been adopted, viz.:—

Nature of Demand.	Diversity Factor.
Public Lighting	Unity.
Business Lighting, internal	Unity.
Business Lighting, external	1.2
Intermittent power	2
Domestic Lighting, general	2
Domestic Lighting, occasional	8
Cooking and Heating	20

The maximum demand occurs between 4.30 and 4.40 p.m.

Business Lighting.—The charge is assessed on watts installed, it being assumed that a consumer does not instal lighting points unless required, and that all internal lighting will be in use at the period of maximum demand. It is not the usual business practice to light up externally until later in the day, and by dividing the ascertained standing cost per KW. by 1.2 any discrepancy lies in favour of the undertaking.

Intermittent Power.—As a general rule 75 per cent. of the total kilowatts installed may be taken as the normal load, but what may be termed the internal diversity should be considered in each case on its merits.

The diversity factor of two has been taken as the relationship of the normal load to the maximum demand.

Domestic Lighting.—A distinction has been drawn between general and occasional lighting. The demand has been assessed upon watts installed.

In fixing the diversity factor at two for general lighting regard was had to the fact that the whole supply would not be in use at 4.30 p.m.

For occasional lighting the factor of eight is not unreasonable, and certainly admits of many additional points being installed which otherwise would be left out.

Cooking and Heating.—It is obviously unfair to make the assessment on watts installed.

In assuming a diversity factor of twenty, three peak times had to be considered. The daily power peaks occur at 11 a.m. and 3 p.m., and, by the lighting peak converging upon the power load, a third peak is created in early winter at 4.30 p.m.

Bearing in mind the bases of charges laid down in this paper, the following example will illustrate the position:

A moderate-size residence of £26 per annum rateable value required a gas service for cooking and lighting costing approximately £10 per annum. To replace this, twenty-two various lights and a 2.4 KW. cooking outfit were installed.

The cost of the service, meter, and wiring installation was £20 5s. 4d., and the cooking outfit £8 10s. 8d. The total number of units supplied during twelve months was 3,128.

The annual assessment was, on the Poplar tariff, 0.352 KW. general lighting at £4, 0.32 KW., occasional lighting at £1, and 2.4 KW. cooking at 8s., amounting to £2 14s. 7d.

The cost of energy, 3,128 units at 0.5d., amounted to £6 10s. 4d., making a total charge of £9 4s. 11d. or 0.71d. per unit.

The hire of the service (12½ per cent. on cost) amounted to £3 12s. 11d., bringing the total bill to £12 17s. 10d., or 0.99d. per unit.

It will be seen that the supply of energy alone compared favourably with the cost of gas, but in order to obtain the supply it was necessary to expend £28 16s., which, of course, must be expected to produce an adequate return.

The author has no hesitation in stating that for prudent reasons the annual charge on account of this expenditure is greater than the anticipated cost.

By dealing with this class of work on a greatly extended scale, the prime cost may be expected to be considerably reduced.

It is also anticipated that the fixed charge per annum will bear a reduction at an early date from £8 per KW. of maximum demand to £6 per KW., and that the diversity factor of two for general lighting may be equitably extended to three, which would halve the general lighting standing charge, and reduce the occasional lighting and cooking.

Taking the revised basis of charge, the following annual result is arrived at, viz.:

	£ s. d.
Fixed Annual Charge	1 13 11
3,128 units at 0.5d.	6 10 4
Or 0.63d. per unit	8 4 3
Service Charges	2 7 6
Or 0.81d. per unit	10 11 9

at which price not only will the supply of energy compete successfully with gas, but the disability of competing with a rival power already in possession of the field will be removed.

In making an investigation of the varied costs which comprise the total cost of supply imposed upon an undertaking, it is necessary to dissect same under three distinct headings:

First, the service cost, or the individual charge on the undertaking directly attributable to each consumer;

Secondly, the fixed cost, or the total sum necessary to carry on the undertaking, irrespective of the amount of energy supplied; and

Thirdly, the running cost, or the actual cost of supplying a unit of energy after making provision for service and fixed costs.

Hitherto, engineers have principally devoted their attention to the reduction in cost of generation in order to supply at the cheapest possible rate, but the reduction in service costs is of considerably greater importance to-day. Reduced cost of generation is generally achieved by *increasing* capital expenditure, but the desired effect in service costs is chiefly brought about by *saving* capital expenditure.

Assuming that the service to the consumer embracing connection to mains, meter, wiring and cooker costs £30, under normal conditions, but by contracting on a larger scale, and exercising closer supervision, this cost can be reduced by 25 per cent., and by careful discrimination in the selection of materials and apparatus the "life" can be extended to fifteen years instead of ten years, the service charge would be lowered from the present rate of £3 15s. per annum to £2 5s., which is double the saving effected by a reduction of 5 lb. of steam per KW.-hour, while the capital employed instead of being increased, would be considerably lowered.

The law underlying the allocation of fixed costs may be briefly stated as follows:—

All charges upon an undertaking of any description—other than service costs—which can be accurately stated, or which can be approximately stated at the commencement of each financial year, are fixed costs.

The sum of the charges thus stated, divided by the maximum demand made by the consumers as a whole, will produce a cost per kilowatt chargeable annually to each consumer, governed by the diversity factor of each class.

On the 1908-09 Poplar figures the total cost of coal alone amounted to 0.354d., but by the transfer to standing costs this figure was reduced to 0.258d., while the remaining running costs brought the total figure up to a fraction over .3d. per unit.

The logic of charging .5d. (after providing for all other costs by the assessment of a fixed charge per annum) is obvious. On a five million unit output the calculated margin is about £4,000 per annum, but allowance must be made for "bad" consumers, discounts and bad debts. The actual result in that particular year was £3,668 gross and £2,702 net.

The relative difference between running and total cost of coal decreases in proportion to the increase of output. With exactly the same plant in use in 1912-13, and the output

doubled the difference amounted to 0.06d. per unit sold, but still an appreciable figure in calculating cost of supply.

The author anticipates that criticism will be made in regard to the human tendency to exceed the number of watts allowed for in the fixed charge; the difficulty in properly assessing the demand where a number of radiators and other domestic utensils are installed; and the opportunity for giving preferential treatment in making assessments. These are weaknesses undoubtedly, but all other systems embody similar weak points without laying claim to the many advantages which are inherent to this system.

Should this system ever become standardized two fetishes of the electricty world must go by the board, viz., "Diversity Factor" and "Load Factor."

Diversity has been exhaustively dealt with; the principal feature of the system outlined is that each consumer obtains the benefit of his own load factor, or in other words, the "good" consumer does not make up for the "bad" consumer.

Hitherto the ideal load obtainable has been that of 100 per cent.

The cooking load offers totally different possibilities. An individual load factor of 10 per cent. is quite usual, but where the diversity is 20 the value of the class is double that of the 100 per cent. individual load factor consumer.

The paper would not be complete without reference to the prepayment system. The author has purposely refrained from introducing this phase of the supply because of the fact that little data are as yet available. It is proposed to go well ahead in Poplar very shortly, but the scheme is not well enough advanced to place before the members.

Discussion.

Mr. C. H. Wordingham, in opening the discussion, said there was a tendency at the present time to try to make people think they were getting something for nothing, but it was soon found that electricity had to be paid for as in the case of any other commodity. He agreed with the author that the municipal electrical undertakings were not indebted to the rates beyond money taken directly from them; excess profits should be kept in the undertaking. He thought that electric cooking would progress, but was very doubtful in regard to electric heating. It was a sound argument that things which had to be kept in a high state of efficiency could be allowed long loan periods. His only comment on the phrase "Municipal enterprise is governed by the laws of equity" found in the paper, was Ha! Ha! Under the stress of "expediency" the author rather departed from his principle of charging in proportion to the cost of supply. Consumers were connected up according to their desire and not in proportion to the capital available. He entirely disagreed with a fixed charge based on the value of a house; it should be based on KW. demand.

Mr. F. M. Long (Norwich), expressed appreciation of the author's analysis of costs; a tariff evolved on principles of equity, as suggested, might not be equally equitable from both suppliers' and consumers' point of view. It was almost impossible, especially for private houses, to base a tariff on the amount of apparatus installed; and it was not really necessary in view of the high diversity factor. The increased loads involved a very small extra capital cost per KW. and there was no need to charge old capital against, say, cooking; the author admitted this in regard to motors. It was possible to put all the high standing charges on the lighting and in that way to charge ½d. per unit for cooking and heating. Private houses should be treated as a class by themselves, and his experience was that rateable value did bear a close relation to demand for lighting by the consumer. The author took as an example a house of £26 rateable value and on the Poplar tariff the fixed charge was £2 14s. 7d., while with the Norwich tariff of 15 per cent. of the rateable value this charge would be £3 18s. 0d., but it would include the cost of service and meter. The author would presumably add at least 15s. for service and meter charges which would bring his charge up to £3 9s. 0d., so that the Norwich system gave much the same result and was much simpler.

Bailie Smith (Glasgow), said a private concern did not pay money to the rates, therefore why should a municipal concern do so? If the latter were necessary the consumer would be better off with a private concern, which added nothing to the price to ficticiously relieve the rates. Under the present system the user of electricity often paid some of the rates of the man next door who used steam and added to the smoky atmosphere of the district. He suggested that steps should be taken to make it illegal to take surpluses for the relief of the rates.

Councillor Crowther (Sheffield), considered that some loan periods were ridiculously short and went on to defend the rateable value system of charging, which was established for other municipal services. In Sheffield out of 107,000 houses, 91,000 were of annual rentals under £15. Between £25 and £30 rentals the houses numbered 1,703, and over £30 rental, 3,618. No house under £15 rental took electricity supply; between £15 and £20, 10 per cent. took it; between £20 and £25, 35 per cent.; between £25 and £30, 40 per cent.; and above those rentals 65 to 70 per cent. of the houses had an electricity supply. The poor houses were not reached, and not one of the 91,000 houses mentioned got any relief from surpluses voted to the rates, as the landlords pocketted this owing to the compounding arrangement. Rate relief only benefitted higher rental houses. He contended that steps should be taken to supply small houses, and that the idea that electricity was a luxury should be swept away.

Mr. H. Richardson (Dundee), thought there was no ground for optimism as to the sales of energy for cooking at the present time, until hiring powers were obtained the cooking load would grow slowly. The consumer had been taught to hire gas stoves, and therefore electric suppliers must be prepared to hire apparatus. He found that at ¾d. per unit electricity for cooking would compete with gas at 2s. 6d. per thousand cubic feet. In Dundee he had tried the rateable value system, but found it difficult, as similar sized houses differed largely in rental. He urged the advantage of a simple tariff.

Mr. A. S. Blackman (Sunderland), congratulated the author on results obtained in a working-class district in East London, which should be an example to other districts. He was surprised that the author should have stuck to the KW. charge when the rateable value system was so much simpler, and could not agree that with the latter system it was a case of handing over to another department the fixing of the electrical standing charges. The 1-KW. radiator was being displaced by 3-KW. and 4-KW. radiators, which were very satisfactory. He urged the members to copy the practice of the draper and fix their charge at, say 1¾d. or 2¾d., rather than 2d. or 3d. per unit; he had found this successful. He did not regard standardisation of tariffs as feasible.

Ald. Sinclair (Swansea), thought that while they might never obtain standardisation of tariffs, they might standardise methods. Neither the rateable value or the KW. charges were really equitable; the former increased the charges to large houses out of proportion to size and the maximum demand system was better in its result. The fixed KW. charge penalised the best and biggest consumer. Electric cooking would not wait for any Bill to pass; it would progress with suitable charges. He thought the time was approaching when engineers would have to disregard peak loads.

Mr. A. H. Dykes (Beckenham) said the paper was valuable if it killed the bogey of "price per unit"; differences in price were not understood by the consumer. There was something wrong in our methods when the small consumer used gas or oil, when it was more expensive than electricity. The author showed that the small consumer could be profitably supplied, and he (the speaker) went on to refer to the progress made in this direction by the Fixed Price Light Co. at Wimbledon, to which reference was made in the Elec. Rev. of May 15th last.

Mr. A. Nichols Moore (Newport) considered the first part of the paper open to very severe criticism, as it might mislead the Councils, whose support was necessary to the engineer in the matter of cheap units. The author was very contradictory, and the speaker came to the conclusion that he was after equity plus expediency. He appeared to base the whole of his theory on diversity factor and to overlook the idea of load factor. He congratulated the author on his allocation of accounts, and thought the real secret of his increasing surplus was in his 86 per cent. of power units. He apparently ignored load factor; cooking only brought him in some £600 a year.

Mr. J. W. Beauchamp (West Ham) said he had never noticed that consumers took the trouble to treat the supply department with equity. There seemed no justification for dropping the secondary charge altogether; if the service rendered was of any value it was worth paying for. Any surplus in aid of the rates should take the form of an electrical asset, such as street lighting. There was a considerable relation between the rateable value and the energy consumed, and his only fear was that it might not remain as at present. Now they got 5-6ths of the revenue as a fixed charge and only 1-6th as an energy charge, and if the assessment were tampered with it would affect 5-6ths of the revenue. This could be got over by fixing the charge on the rateable value but not disclosing this to the consumer, in which case the charge could be maintained even if the assessment were decreased. A point in favour of the rateable value was that if small C.P. half-watt lamps were introduced, the drop in revenue should only affect 1-6th of the receipts, but he was afraid the consumer would ask for a share of the plunder.

Mr. Grogan did not see why the electric light bill should be reduced just because the consumer succeeded in reducing his rates; the engineer was the only man who could judge what was an equitable tariff. The author, towards the end of his paper, referred to cooking load possibilities, and apparently stated that with a 10 per cent. load factor, and 20 per cent. diversity factor, he would obtain a class of consumer with a 200 per cent. load factor; he would be glad to hear this explained. The diversity factor for cookers of different types would probably change with the introduction of quick-heating stoves.

Mr. H. R. Burnett (Barrow-in-Furness) wished to correct the idea that it was necessary to give away electricity to get small consumers. In Barrow they were supplying about 1,000 artisans' houses; originally this was done through prepayment meters and much dissatisfaction existed. Two years ago a fixed charge based on the rent plus 1d. per unit was substituted, and it was found that these consumers took 100 per cent. more energy but were quite satisfied. He failed to see why, instead of the rateable value system, engineers should not fix a value based on the KW. He felt that some gentle-

men had in the pursuit of notoriety allowed their judgment to be over-ruled as regarded the fixed charge.

This concluded the discussion, to which Mr. Bowden is to reply in writing.

Tariff Standardisation.

To the layman, and particularly those connected with the direction of municipal and private electricity undertakings, it is a matter of wonder and some anxiety that station engineers should differ so widely and so continuously concerning the methods and rates by which their commodity is sold.

The reasons for the present welter of tariffs are primarily that :—

The engineer is, by training, scientific, and in making tariffs is apt to strain at an excellence not usually achieved in commerce.

He labours under restrictions, to some extent imaginary, with regard to the equitable treatment of consumers.

But the chief cause for so much disparity in methods of charging lies in the fact that many present-day tariffs are designed to create demand, and where they succeed in this object they naturally tend to destroy themselves in the process.

Examples of similar fluidity in price-making surround us in regard to other growing commercial enterprises which, however, are not obliged to work within those restrictions which have been placed upon electricity supply under the impression that the providers would enjoy the benefits of monopoly, which, as a matter of fact, they only do to a limited extent and by virtue of competitive effort.

The paper read by Mr. Bowden before the I.M.E.A., in Birmingham, is a most valuable contribution to this subject, the more so because he has worked persistently, if quietly, for many years with the object of providing electricity for all purposes on a common and equitable basis of charge ; in doing this he has consistently adhered to a scientific foundation, and has not hesitated upon occasion to adopt an independent attitude with regard to certain aspects of tariff making. That his work has been justified is amply demonstrated by the results achieved in Poplar, and by the attention given to any contribution from his pen upon this important subject.

The fact that the author stands for a certain school of thought in municipal policy in no way weakens the value of his work, although it must oblige many to accept his more general conclusions with reserve.

He strikes a somewhat unusual note in a Convention paper by inviting the attention of members of electricity committees to his problem, and suggesting that they may assist in no small degree in its solution ; for this attitude there is much to be said, but it is sincerely to be hoped that the responsible managers will make a co-operative study of the subject with a view to giving their committees a strong lead in this as in all matters affecting the policy of their undertakings. The success of any commercial enterprise depends upon the sane and continuous policy of one or a very small number of individuals, whose whole time and interest is devoted to the business, and upon his or their power to command the confidence of the governing body—from the members of which most valuable assistance can, it is true, be obtained, but rather in the direction of query and criticism than in that of construction.

Those who are familiar with the author's views on the subject will not be surprised at the insistance with which the paper refers to cost as the main basis of charge and to the desirability of supplying at the lowest price possible having regard to the stability of the undertaking. With regard to the value of the service to the consumer he is silent, and it behoves the engineer to consider this omission with care and examine the foundations of his own commercial beliefs in dealing with the question of tariffs.

There appears to be no sound reason for selling any commodity at a price lower than its value to the user subject to such reduction as may be needed to induce him to abandon the use of competing commodities or to attract him to areas where the facilities can be enjoyed.

Persistence in such a course could only widen the gap existing between the charges for private and municipal supplies, damage competitors to an unnecessary extent, and weaken the undertaking by depriving it of surpluses which might be devoted to development of the business, and so ultimately to the benefit of the community served.

It must be remembered that in framing tariffs, one should most carefully ensure against the need to advance rates in the future, than which nothing can be more disastrous to a competitive business, particularly in the case of electricity supply where the consumer is often called upon to expend large sums on apparatus to enable him to take advantage of the service.

In this matter, the current practice of commerce is typified by the action of tradesmen in the West End, who, having met the needs of their customers in the day time at current prices, do often dispose of their surplus stock to the poor at night for any reasonable figure. In each case the consumer pays what the goods are worth to him in view of his circumstances, and no complaint arises.

On the disposal of surplus profits the author is emphatic, declaring for the smallest of contributions to the ratepayers and these in the form of public improvements. The mind is agreeably stimulated by the conception of a public park provided from the profits of electricity supply, and adorned with statues of the engineers whose efforts have brought it into being.

It would appear, however, that the soundest method of disposing of any surplus which can really be spared after providing for plant improvement, contingencies, and the reduction of hire charges on consuming apparatus, would be to offer the community some assets of an electrical character which otherwise it would not feel justified in obtaining, as, for instance, public time service, a more generous scheme of street lighting, electric vehicles for Corporation use, &c. In this way the profits distributed would benefit all, and allow none to forget the source from which they came.

On the subject of loan periods, Mr. Bowden will probably arouse criticism ; he is, perhaps, a little unfair to the L.G.B. and L.C.C., whose object is probably nothing more than to equate the repayment period to the actual life of an adequately repaired item of plant ; in point of fact, the officials of these authorities do realise that a cable will last indefinitely, and a turbine may be kept moving for more than 15 years, but who will venture to say that any generating plant or mains system put in to-day will be profitably employable in even 10 years from now ?

The author's view of the time when secondary charges may be dispensed with and unlimited service given for a fixed sum per annum, appears open to question ; that such systems exist we are aware, but suspect that in certain areas where "white fuel" is available, it is found cheaper to allow unlimited use than to meter the supply, and that most of such contract consumers are not in a position to obtain heating and cooking apparatus.

Arguments in favour of an unlimited supply for a fixed price per year of maximum demand are often based upon a fallacious analogy between the service of water and electricity ; to a man of ordinary means a continuous supply of electricity offers possibilities of heating and power which he would not be slow to take advantage of under an unrestricted contract, whereas a supply of water, although absolutely necessary, is of limited utility, and offers no advantages beyond the satisfaction of certain daily wants. It will be noted that even the water companies impose an extra charge in summer for garden use, and the consumer who tries to improve their load factor by the erection of a fountain or a water motor, will soon be asked to accommodate a meter and pay a secondary charge.

Under our own conditions the author appears to look to the sale of coal by-products for the revenue which will enable him to dispense with secondary charges. Here he enters upon doubtful ground. The price of such by-products may vary widely with the supply of and the demand for them, and in any case he is departing a little from his standard of equity in suggesting that the farmer shall pay more than he need for his fertiliser in order to let his customer, the townsman, cook his vegetables free. Such conditions might conceivably lower the cost of

living, whilst raising the price of food in a way which would sorely puzzle the economist!

The rateable value system of charging comes in for severe criticism at the hands of the author, and it certainly contains elements of danger which should have the consideration of those who are attracted by its simplicity; invented for use in a residential district where considerable uniformity of property exists, it has been very successful and is, perhaps, now in danger of becoming a fashion without regard to its limitations, and the fact that the bulk of the revenue is measured by a standard over which the supplier has no control, and which may be subject to variation under some altered scheme of taxation.

The paper, a lengthy one, is full of interest and contains valuable figures with regard to the Poplar undertaking; it is safe to say that with the discussion it will take its place as a useful work of reference with some few other classic papers on this, the most elusive and fascinating problem which lies unsolved before the supply engineer of to-day.

INTERNATIONAL RUBBER AND ALLIED TRADES EXHIBITION.

THE Fourth International Rubber and Allied Industries Exhibition and the First International Cotton, Fibres and other Tropical Agricultural Products Exhibition was opened on Wednesday, June 24th, by Prince Arthur of Connaught, and will close on July 9th. Over fifty British and Foreign Governments are taking part officially in this exhibition. Their participation undoubtedly makes the latter representative and of great interest and value to experts, but to the laymen one Government exhibit is distressingly like another, and we question whether the ordinary visitor—whose shilling is, presumably, as much desired by the organisers as that of the rubber expert—will not find a little wearisome the many (individually excellent) collections of photographs and samples of rubber in its various stages of preparation shown by the exhibiting Governments and rubber companies. To the expert these exhibits are, of course, most valuable, and the layman will find them more interesting if taken in conjunction with certain of the special articles in the official handbook and the particulars there given of entries for the numerous trophies open to competition. The official handbook and catalogue, compiled and edited by Mr. A. Staines Manders, is a volume of well over 1,000 pages, containing nearly 70 special articles, fairly well indexed, and constituting a most valuable cyclopædia on rubber, cotton and fibre topics. The published net price of this volume being 5s., visitors should purchase copies at 1s. in the exhibition building; besides forming a detailed (and ponderous) guide to the exhibits, the work is one of real technical merit.

Considering the great importance of rubber in its many forms in the electrical industry, we are surprised and sorry to find so little of direct electrical interest in this exhibition. Anything connected with the production of good and cheap rubber is of electrical, indeed, national, interest and importance, but surely more rubber firms could have shown rubber in its specific electrical applications, while electrical firms might have done much to show uses for electrical apparatus in the rubber industry. The exhibits of rubber washing, mixing, sifting, forcing and grinding machines, presses and elevators, etc., while excellent in themselves, offer no features of special electrical interest. Any electrical firm arranging an exhibit to show applications of electric driving and electric heating in rubber preparation and vulcanising might have reaped a good harvest.

Messrs. Pirelli, Ltd., show, in addition to rubber goods of practically every other class, light and heavy electric wires and cables for all purposes; insulating strip and compounds; and ebonite sheet, rod, telephone parts and battery cells, etc. In King George's Hall, the Leyland and Birmingham Rubber Co. show a distinct novelty in the shape of a rubber tennis court paved with British-grown plantation rubber. Even more interesting, in view of the vast possibilities which it offers for rubber consumption, is a section of the actual rubber-paved roadway laid in the Old Kent Road, nearly twelve months ago, at a point where traffic is very heavy. Much experience has been gained from this experiment, and, considering that this was the first piece of rubber street paving ever laid, the rubber has stood remarkable well. Among the some thousands of other rubber articles shown by this firm (which should stand a good chance of winning the prize offered for greatest variety) may be mentioned special railway, surgical and tiling goods, besides the infinite variety included under the heading "mechanical" rubber goods.

The North British Rubber Co., Ltd., show asbestos packing, rubber belting for power transmission and conveyors, band and solid tires, rubber mats, tiling, paving and piping of every description, besides examples of practically every other class of rubber goods. The same firm is responsible for the Rubber Room, which shows an extraordinary variety of forms and applications of rubber. From the delicate window curtains to the legs of the substantial settee, from the entrance mat and room carpet to the wall "paper" and picture frames, everything in this room is of rubber. The Polack Tyre & Rubber Co., Ltd., have an interesting exhibit of their well known steel-backed solid tires and fresh remarkable record mileages to communicate. We are glad to see that they emphasise the importance of good tires on electric vehicles and the assistance rendered by each to the development of the other. Louis Schopper (Leipzig) shows a number of rubber testing machines and accessories deserving careful inspection by all visitors interested in the specification, testing and purchase of rubber. The United States Rubber Reclaiming Co. have arranged exhibits showing stages in the reclamation of rubber and testing apparatus for determining the breakdown strength of and leakage current through rubber insulation.

In the Balcony visitors should inspect the co-operative collection of articles made from india-rubber. This extensive collection shows to what extent rubber enters into every phase of modern life and activity. One of the most instructive official exhibits is that organised by the Belgian Government (and reminiscent of Ghent). The six sections cover the history and manufacture of rubber and deal with Belgian commercial and social activities in the Congo, and include a number of trade exhibits.

Many exhibits of raw, prepared and manufactured plantation rubber are included, and the layman cannot fail to be impressed by the excellent appearance of the plantation samples exhibited. In being thus impressed, he will fall into the first and most tempting of the traps which await the unwary, for appearance counts for little in this connection; indeed, in creping rubber, good appearance is apt to be purchased at the cost of lost nerve and increased difficulties of vulcanisation. Doubts are still expressed as to whether plantation rubber is as uniform and reliable as the wild product. Certainly it seems to us that it should be so, and that the brightest prospects for plantation rubber are to be found in the fact that its production is (in all ordinary cases) well organised and efficiently conducted, so that costs can be kept to a minimum and profitable working continued (where companies are not over-capitalised), even with rubber at 1s. 6d. per pound. Tire manufacturers and users will find much to interest them in the plantation rubber tires on view, with full particulars of service tests to which they have been subjected. This important topic will doubtless be discussed at the International Conference, hence some definite conclusion as to the best tire rubbers should soon be forthcoming. The subject of synthetic rubber and its prospects in competition with wild and plantation rubber was discussed briefly by Prof. W. R. Duncan in his presidential address to the International Congress of Tropical Agriculture, and this topic also will receive further attention during the Rubber Congress, opened on June 30th by the President (Sir Henry Blake). As in previous exhibitions, many important papers are to be read and discussed at this congress, and the proceedings, which will be published in book form, will constitute a fitting memorial to the part played by the International Rubber Exhibitions, in conjunction with systematic observations and experiment, in advancing the technique of rubber production and manufacture during recent years.

In the balcony cinematograph hall, films are exhibited to show the manufacture of rubber goods in the Edinburgh works of the North British Rubber Co., the production and preparation of rubber on plantations, and so forth. The general arrangement of the stands and exhibits is excellent, maximum advantage being taken of the space available while eliminating completely the monotony of rectilinear gangways. Provisions for the comfort and entertainment of visitors are numerous and elaborate.

The Batti-Wallahs' Outing.—The Batti-Wallahs' Society went for their summer river outing on Saturday last. The attendance showed an advance on last year's figures; in all about 90 Batti-Wallahs and their ladies and friends participated. Mr. D'Arcy, of the B.T.H., by his services at the piano, contributed largely to the success of the impromptu concert on board. The company started from the Sun Hotel, Kingston, at 2 o'clock, and tea was served at 3.30 at the Weir Hotel, Sunbury. On arrival at the Lincoln Hotel, Weybridge, an excellent meal was provided, and the party returned to Kingston about 9 o'clock. Amongst prominent Batti-Wallahs present were President Avila, Past-president and Mrs. Snow Huddleston, Mr. and Mrs. F. Pooley, Mr. and Mrs. Ashley Pope, Mr. and Mrs. Prangnell, Mr. and Mrs. Barfield, Mr. and Mrs. Wyld, Mr. Lange, Mr. and Mrs. Newton Russell, Mr. R. W. Hughman, Mr. and Mrs. Fisher, Mr. and Mrs. Sharp, Mr. and Mrs. Denison, and Mr. Ralph Ball.

A Large Steam Turbine.—A large turbine has recently been completed in the shops of MESSRS. BROWN, BOVERI & CO., of Mannheim, for the Mark Communal Electricity Works Co., of Hagen. It is of 40,000 H.P., and has been built to work with superheated steam at 350° C. and 12½ atmospheres, and with a surface-condensing plant with cooling water at 12° C. The speed is 1,000 R.P.M., and the generator produces three-phase current at 11,000 volts and 50 periods. The length of the set is 16 m., and the width 4·2 m., the total weight being 385 tons with condensing plant. A train of 10 special trucks is required to transport the plant to its destination.

INNOCENCE AT SAFFRON HILL.*

WE are loath to believe in metempsychosis, yet ever and anon come stray bits of evidence from the circumambient ether or elsewhere that almost persuade us to confidence. Just now comes a projection of odic force or something like that, from an etheric vibrator, or its kin, at Saffron Hill, which suggests with convincing force the reincarnation of the late Prof. Keeley. A French gentleman, with a long enough American experience to acquaint him with the commercial value of publicity, has been weaving spells about the London daily Press in a way to suggest the finest efforts of the lamented M. Svengali. By tradition one looks upon the London newspaper man as partaking somewhat of the hard-headed materialism usually attributed to this country, but in this instance he appears in the genial confiding rôle of a Wall Street lamb.

The inventor of the latest traction marvel, 300 miles an hour at no particular expenditure of energy, seems to have taken his cue from the alleged exploit of the Fish Commission of crossing the shad with the jelly fish to avoid bones, and has produced a fearsome blend of the late New England Portelectric system with the principles of electric dynamic repulsion enunciated by Prof. Elihu Thomson in a notable lecture before the Institute some twenty-odd years ago. His car, cigar-shaped as befits all of its kind, is hurled through space by the attraction of a series of solenoids distributed along the track. Meanwhile it is booted out of contact with the supporting structure by a series of alternating current magnets which impel it as it flies through space. It has no wheels save those supplied by the inventor and the admiring reporters. The result is, according to the inventor, that it practically eliminates all friction by floating in the air, and can be driven at almost any speed desired with the expenditure of very little power. Besides such an achievement as this the Brennan mono-rail system and all that has gone before it sink into utter insignificance. If two sets of wheels imply formidable friction and one set of wheels very little, then surely no wheels at all should bring complete escape from all the confines of dynamics. And the most delightful feature of the invention is that reporters, politicians, a worthy admiral or two, and other non-technical persons seem to have taken it with true British seriousness. A friendly acquaintance with our engineering confrères on the other side of the water had almost persuaded us that the supposed inability of the Briton to see a joke was baseless slander, but the incident of Saffron Hill brings us grave evidence to the contrary. We have looked in vain for a telltale "Advt." at the bottom of the newspaper accounts of this marvel, and have wondered.

To be serious, we do not fancy that our American readers, hardened as they are by a long series of epoch-making inventions that have not worked, will attach very much importance to this latest marvel, nor do we think that American tramways will be denied sufficient capitalization to lay tracks and run motors thereon for some time to come. The American investor now hails from Missouri, although to judge from these latest reports, a sanitarium in that exhilarating climate might profitably be colonized from London. We shall await further details of the hypnotic project from Saffron Hill with vast interest. In the meantime we shall only suggest that those who think that M. Bachelet has discovered a new principle in transportation might look up with advantage the history of the other systems which have been proposed along this line. The same objection applies to them all, and is expressed in our comments on the Albertson car about ten years ago, when we said editorially, "Why this struggle to avoid the smallest item of resistance at high speeds? Has not the Professor ever heard of air resistance, or does he plan to run his train in vacuo? If rolling friction, due to weight on the wheels, and track resistance properly so called, were the only obstacles to high speed, railroading would be a joy for ever. The hundred-mile-an-hour train would be a back number, and no up-to-date witch would ride anything so slow as a broomstick."

Electrifying the Belgian State Railways.—In examining this problem, J. Carlier assumes the cost of electrical energy delivered to the third rail as high-pressure D.C. to be 0·6d., including capital charges, or 0·78d. per KW.-hour at the driving wheel, assuming 30 per cent. less between conductor rail and driving wheels. Average annual costs per train-mile under the existing steam system are:—Wages, 2·6d.; fuel, 5·7d.; stoking, 0·24d.; lubrication, 0·225d.; various, 0·93d.; total, 9·7d. per train-mile. Under electric working, it is estimated that corresponding charges would be:—Wages, 2·62d.; fuel, 3·19d.; lubrication, 0·16d.; various, 0·32d.; total, 6·3d. per train-mile, *i.e.*, about 35 per cent. less than the present total. The total cost of the Belgian State Railway system being at present about £2,190,000, electrification would result in an annual saving of, say, £770,000. Traffic density could be increased 30 per cent. by electrification, thus securing a much better return on invested capital.

"Lest we Forget!"—In his report to the Board of Trade on the collision between an express train and a goods train at Burntisland on April 14th, Major Pringle states that he has no doubt that the origin of the fires which broke out was "burning gas."

* *Electric Railway Journal.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Beta" Type Midget Automatic Accumulator Switch.

Where a smaller type of automatic accumulator switch than the Crawley is required, and it is necessary to arrange for a minimum amount of space on the switchboard, this new design of MESSRS. NALDER BROS. & THOMPSON, LTD., offers many advantages. Like the Nevile automatic, the new type of instrument has a permanent magnet, but in the case of the "Beta" Midget it is arranged so that it cannot be reversed; in fact, the action of the switch in use

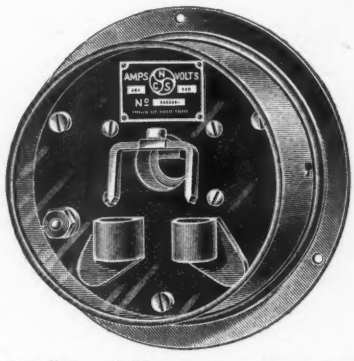


FIG. 1.—N.C.S. "BETA" MIDGET AUTOMATIC ACCUMULATOR SWITCH.

is to reinforce the magnet instead of reversing it. This instrument, like the Crawley automatic, is purely differential in its action, and is joined up in the manner indicated in the diagram, fig. 2.

As in the original pattern of Midget automatic battery switch, minimum weight is secured on the moving part, as the differential coil is wound on the same bobbin as the current coil, and not on the moving iron, consequently the mass to be moved is very small. Compactness in design is secured by arranging for part of the instrument to be let in flush with the board; only that part of the mechanism carrying the mercury cups and the dipper stands

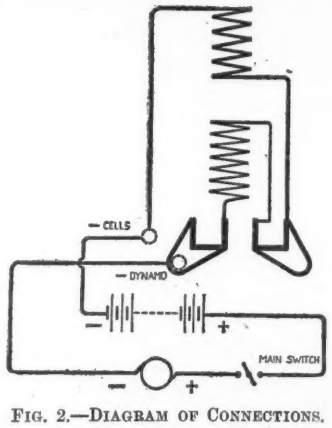


FIG. 2.—DIAGRAM OF CONNECTIONS.

out on the front of the board. These are protected by a glazed polished brass case, which can be easily removed. This is a point of advantage, as where skilled labour is not employed, instances have occurred in which the dipper has been tampered with.

Generally speaking, this instrument is only made for voltages up to 80 volts, and currents up to 50 or 60 amperes. The diameter of the hole which it is necessary to cut in the board is 5⅞ in.

Push-Button Speed Control.

THE IGRANIC ELECTRIC CO., LTD., of 147, Queen Victoria Street, E.C., have introduced an improved method of push-button control, in which the speed of the motor, as well as the starting and stopping, is controlled by push buttons and the same completeness of control is attained as is usual with large rotary newspaper machines, but the new system now under discussion is much more simple and less costly.

Fig. 3 shows the complete controlling panel, which has only one solenoid and a number of clapper switches.

The solenoid is compensated so that the lever which it controls remains on any resistance contact according to the wish of the attendant who is manipulating the push buttons shown in fig. 4.

For instance, if the "start" button is pressed momentarily, the motor starts up but runs only at the lowest speed, whereas if

pressure on the button is maintained, the motor will gradually accelerate, finally attaining full speed.

If it is required to reduce the speed, the operator presses the "retard" button until the motor is running at the required speed.

Pressing the "inch" button causes the motor to run at its lowest speed so long as pressure is maintained, but the motor stops immediately the pressure on the button is released.

A depression of the "stop" button will always cause the motor circuit to be opened; the "stop" button acts as a master button and always prevails over the others.

Various combinations of armature and shunt field resistance and also armature diverter resistance are used to obtain suitable

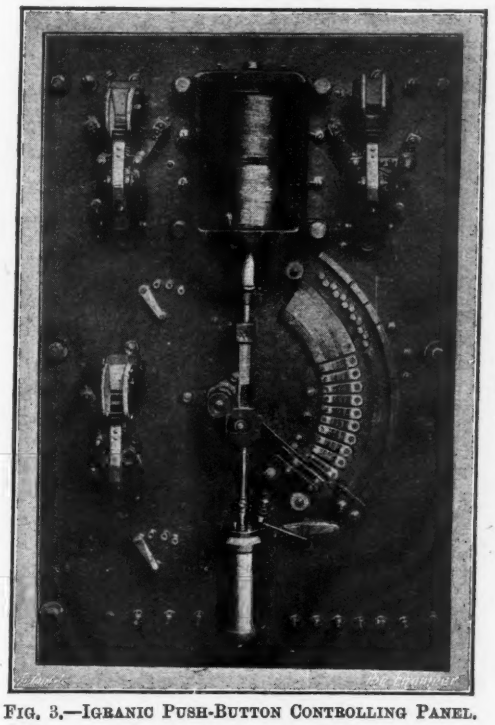


Fig. 3.—Igranic Push-Button Controlling Panel.

ranges of speed regulation, for any particular requirement, and the main motor circuit is always handled by the clapper switches, no matter which push-button is being operated.

The sliding contacts on the switch front are, therefore, only used for cutting the various sections of resistance in or out, never being called upon to open or close the motor circuit, and thus they are not subjected to injurious sparking or burning.

All the clapper switches are completely interlocked so as to render careless or malicious mis-handling perfectly harmless, and

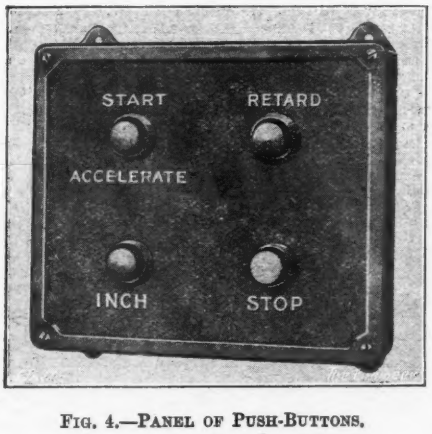


Fig. 4.—Panel of Push-Buttons.

at the same time to offer complete protection to the motor and to the machine in its driving.

The Igranic Co. inform us that a number of these new controllers are already at work, and that some of them have produced repeat orders.

The controller is capable of being applied to rotary web presses driven by either one or two motors, and it is claimed to have many advantages in the control of some kinds of machine tools.

"Grundy" Temperature Control Apparatus.

From Messrs. Schonfield & Co. (Glasgow), of 21, Hope Street, Glasgow, we have received particulars of the "Grundy" system of temperature control, which has been successfully applied for the automatic control of the electric heating of rooms, to water heating, and to the control of ventilating fans, amongst other things.

The essential part of this apparatus is the "Grundy" thermostat, shown in fig. 5, which is of the bi-metallic type. Instead of "straight-on" or "rubbing" contact, a small glass tube con-

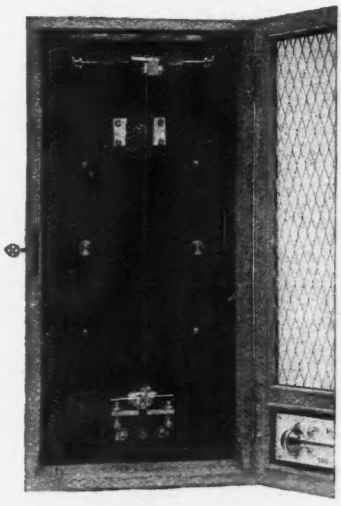


Fig. 5.—"Grundy" Thermostat.

taining a globule of mercury is used, which, on being overbalanced by the thermostatic strip, gives a quick and positive contact, which operates an automatic relay switch, fig. 6, which in its turn controls the heating or ventilating apparatus.

A predetermined temperature can be maintained within a mean variation of ½°C. The thermostatic strip is free to bend to an

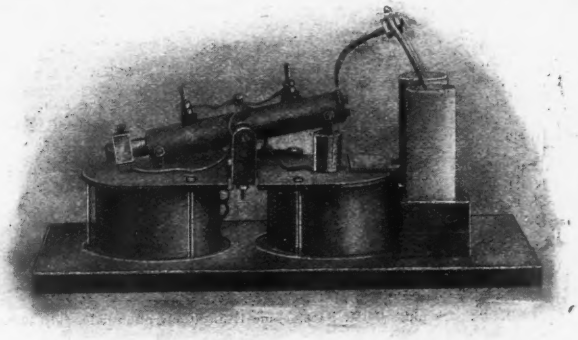


Fig. 6.—"Grundy" Relay Switch.

unlimited extent after overbalancing the mercury tube, and the thermostat can be adjusted to any temperature between 30° and 90° F.

The armature switch is specially adapted for use with the "Hestia" electric stove supplied by Messrs. Schonfield, although it can be applied to any electric heater, or for bringing a fan into operation when the temperature of a room rises above a predetermined amount.

The "Hestia" stove has a cylindrical ruby glass body giving a subdued glow when in use; the heater is guaranteed for five years, and a special feature is a portable water belt for moistening the heated air, and thus preventing the latter from becoming dry and unpleasant to breathe.

A Device for Cleaning Silver.

Mr. J. M. Hotchkiss, of Fairfax, U.S.A., has devised a simple method of cleaning gold, silver, and other metal ware without friction and consequent attrition of the surface, and without dissolving the metal or otherwise injuring the articles treated. The method is electrolytic in character, and is carried out with a zinc tray or frame provided with a grid of copper bars, on which the ware to be cleaned is placed; the whole is immersed in a solution of common salt in the proportion of about two tablespoonfuls of salt to a quart of tepid water. The silver being electro-negative to zinc, the combination forms a voltaic cell, liberating hydrogen at the surface of the silver, and the nascent hydrogen reduces the oxide or sulphide with which the silver is tarnished, leaving the surface bright and clean. We have tried the process and find it perfectly efficient and satisfactory; even in the case of silver that appeared to be untarnished, the added lustre resulting from the application of the process proved that an invisible film of tarnish had been present. The patent rights for the appliance are in the hands of Messrs. Lund Bros. & Co., of 78, Queen Victoria Street, London, E.C.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

14,311. "Electrically-operated reciprocating apparatus." T. F. WALL. June 15th. (Addition to 9,893/13.)

14,316. "Electric traction motors." C. TURNBULL, JUN., & W. T. DALTON. June 15th.

14,342. "Combined insulating and fastening means for rails." W. R. GORRELL. June 15th. (Convention date, April 20th, 1914, United States.) (Complete.)

14,358. "Means for conveying articles through the bath of an electro-plating or other apparatus." C. K. MILLS. June 15th. (Hanson & Van Winkle Co., United States.) (Complete.)

14,376. "Means for controlling the use of keys or other articles, but primarily keys employed in connection with electric locking signals." A. A. JEWELL & F. S. JEWELL. June 15th.

14,377. "Manufacture of metallic filaments for incandescent lamps." T. T. BAKER. June 15th.

14,378. "Process for starting a combined rotary converter and a synchronous generator set." SIEMENS BROS. DYNAMO WORKS, LTD., & C. A. B. D. KOETTGEN. June 15th. (Complete.)

14,379. "Implement for laying cables or wires in the ground." R. H. FOWLER. June 15th. (W. Turner, Germany.) (Complete.)

14,380. "Regulation of alternating or three-phase current generators. VOIGT & HAEFFNER AKT. GES. June 15th. Convention date, June 16th, 1913, Germany.) (Complete.)

14,381. "Rendering tungsten ductile." C. TRENZEN. June 15th.

14,384. "Switching-arrangements for rotary converters. SIEMENS BROS. DYNAMO WORKS, LTD. June 15th. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

14,392. "Fittings for metallic conduit systems of electrical wiring." T. MANSON. June 15th

14,394. "Electric heaters or resistance elements therefor." J. R. QUAIN. June 15th.

14,415. "Dynamo-electric machines." H. H. JEFFCOTT. June 16th.

14,438. "Means of applying the radiating properties of aluminium or other metals or alloys to the cooling of sparking-plugs, compression taps, and exhaust valves of all internal-combustion engines or to the cooling of the cylinders of air-cooled internal combustion engines." F. H. KITCHIN. June 16th.

14,439. "Telegraphone." F. SEELAU & A. M. NEWMAN. June 16th. (Convention date, August 22nd, 1913, Germany.) (Complete.)

14,440. "Cylinder record magazine for phonographic talking-instruments, particularly telegraphones." F. SEELAU & A. M. NEWMAN. June 16th. (Convention date, October 16th, 1913, Germany.) (Complete.)

14,441. "Telephonic receiver and transmitter boxes with phonograph styles." F. A. SEELAU & A. M. NEWMAN. June 16th. (Convention date, September 1st, 1913, Germany.) (Complete.)

14,469. "Electrical heating-apparatus." A. F. BERRY. June 16th.

14,470. "Means for controlling the heating effect of electric heating-apparatus." A. F. BERRY. June 16th.

14,471. "Electric switches." A. F. BERRY. June 16th.

14,474. "Electric fuses." W. D. HENSELL. June 16th. (Convention date, June 18th, 1913, Australia.) (Complete.)

14,483. "High-tension electric apparatus." MEIROWSKY & CO. AKT. GES., and K. FISCHER. June 16th. (Complete.)

14,494. "Electro muscle-developing machine. T. MAHER. June 17th.

14,504. "Metallic insulated nipple or bush with or without bonding or earthing connexion for electric metallic conduits." T. TOPPING. June 17th.

14,513. "Method of and apparatus for use in, and in connection with, electrolytic processes." A. E. BATTLE. June 17th.

14,514. "Electrolysis of metals." A. E. BATTLE. June 17th.

14,521. "Thermo-electric generators." P. FERRA. June 17th.

14,548. "Electric switches." J. H. TUCKER. June 17th. (Divided application on 19,388/13. February 27th, 1914.)

14,557. "Electrical measuring-instruments." I. W. BROGGER. June 17th. (Complete.)

14,558. "Sparking-plugs for internal-combustion engines." S. R. JACKAMAN. June 17th.

14,561. "Spark plugs." M. RALL. June 17th. (Convention date, July 10th, 1913, France.) (Complete.)

14,567. "Transmitting rotary motion." JANDUS ARC LAMP AND ELECTRIC CO., LTD., and A. D. JONES. June 17th. (Complete.)

14,577. "Systems of electric distribution." BRITISH THOMSON-HOUSTON CO., LTD. June 17th. (General Electric Co., United States.)

14,582. "Electrode-making machines." S. L. CASELLA. June 17th. (Convention date, July 3rd, 1913, United States.) (Complete.)

14,595. "Mechanical selector for electromagnetic waves applicable to wireless telegraphic receiving apparatus." R. B. GOLDSCHMIDT. June 17th. (Convention date, December 29th, 1913, Belgium.) (Complete.)

14,617. "Insulating fittings." IOCO PROOFING CO., LTD., and N. B. ROY. June 18th.

14,623. "Recipients for electric storage cells." G. DAVIS. June 18th.

14,638. "Safety apparatus for use with electric lighting installations." SOC. ANON. DES AUTOMOBILES ET CYCLES PEUGEOT. June 18th. (Addition to 21,445/13. Convention date, July 8th, 1913, France.) (Complete.)

14,642. "Electric-alarm show-stand." A. H. IRWIN. June 18th.

14,643. "Accessories for use in connection with telephones." R. F. HOWELL and R. P. MULHOLLAND. June 18th.

14,669. "Electric candle lamps." C. DAMEY and G. BRADLEY. June 18th.

14,683. "Tensioning-arrangements for overhead electric conductors. SIEMENS SCHUCKERTWERKE G.M.B.H. June 18th. (Convention date, June 21st, 1913, Germany.) (Complete.)

14,686. "Portable electric-lamp dry batteries." J. S. HAMILTON. June 18th. (Divided application on 3,643/14. February 12th.) (Complete.)

14,695. "Means of reading the indications of magnetic compasses, clinometers, and the like." J. H. STEWARD, LTD. June 19th.

14,697. "Electric projectors and the like." W. T. COULSON. June 19th.

14,698. "Electricity meters." H. J. FISHER. June 19th.

14,739. "Apparatus for continuously disinfecting telephone mouthpieces." H. H. MAHIEU. June 19th. (Complete.)

14,746. "Electrical conduits and the like." H. H. LONGBOTTOM and T. FARRAR, trading as STEEL TUBES & CONDUITS CO. June 19th.

14,747. "Combination clutch and switch for motor vehicles and the like." G. H. C. LUMSDEN. June 19th.

14,767. "Compounds for use as coatings or coverings for insulating purposes and the like or for making slabs or blocks." A. J. ROACH-CUMING. June 19th.

14,768. "Compounds for use as coatings or coverings for insulating purposes." A. J. ROACH-CUMING. June 19th.

14,780. "Process for producing a filling-material for use in connection with direct-current converters." K. SIEVERS and O. MUNCH. June 19th. (Complete.)

14,789. "Incandescent electric lamps." E. B. Y TORRENS. June 19th. (Convention date, October 30th, 1913, Spain.) (Complete.)

14,798. "Telephonic transmitters and receivers." INTERNATIONAL ELECTRIC CO., LTD. June 19th. (Akt. Ges. Mix & Genest, Germany.) (Complete.)

14,800. "Apparatus for and method of operating electric signs, devices, indications and the like." L. MARTIN. June 19th.

14,808. "Telephone systems." R. H. BURFEIND. June 19th. (Convention date, June 21st, 1913, United States.) (Complete.)

14,817. "Electrical condensers." BRITISH INSULATED AND HELSBY CABLES, LTD., E. A. BAYLES, and H. HIGHAM. June 20th.

14,824. "Electric water sterilisers." C. W. DENNY. June 20th.

14,825. "Electric ozone generators." C. W. DENNY. June 20th.

14,834. "Electrical condensers." A. J. B. E. DARRAS. June 20th. (Convention date, June 21st, 1913, France.) (Complete.)

14,841. "Electricity meters of the mercury motor type." CHAMBERLAIN & HOOKHAM, LTD., and W. S. SPRAGUE. June 20th.

14,861. "Manufacture and construction of commutators for dynamo-electric machines." A. H. MIDGLEY & C. A. VANDERVELL. June 20th.

14,884. "Spark gaps for radio-telegraphy." E. GIRARDEAU & J. BETHENOD. June 20th. (Convention date, June 23rd, 1913, Belgium.) (Complete.)

14,891. "Receivers for use with electrical apparatus for transmitting and receiving signals." SIR A. T. DAWSON and G. T. BUCKHAM. June 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

5,157. ELECTRICITY METERS. J. Elster. February 28th.

5,310. SYSTEM OF GUN CONTROL. A. H. Wegner. March 3rd.

5,352. ELECTRO-MAGNETICALLY CONTROLLED PERFORATING APPARATUS. B. Soldatencow. March 3rd. (March 16th, 1912. Patent of addition not granted.)

10,000. APPLIANCE FOR TESTING THE HEARING OF PERSONS, PARTICULARLY APPLICABLE TO DEAFNESS. E. T. Hincks. April 20th.

10,200. TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) April 30th.

10,399. TELEPHONES. A. Plecher. May 2nd

12,421. MANUFACTURE OF TUNGSTEN METAL BODIES. C. Gladitz. May 28th.

12,723. TESTING OF INSULATION. Evershed & Vignoles, Ltd., and S. Evershed. May 31st.

12,740. CONSTANT-TEMPERATURE ELECTRICALLY HEATED OVENS. T. B. Freas. May 31st.

12,950. SIGNS OR ADVERTISEMENTS, ALSO APPLICABLE TO OTHER DEVICES USED FOR DISPLAY OR LIKE PURPOSES, AND FORMED WHOLLY OR PARTLY OF GLASS OR OTHER TRANSPARENT MATERIAL. W. J. Beville. June 4th.

12,966. CALLING DEVICE FOR TELEGRAPH OR TELEPHONE CIRCUITS. C. W. Lund and New Phonopore Telephone Co. June 4th.

13,015. MACHINES FOR INTERMITTENTLY DISPLAYING POSTERS AND THE LIKE. E. W. Brown. June 5th. (Cognate applications, 15,292/13 and 25,259/13.)

13,065. CALLING OR ALARM APPARATUS FOR USE IN WIRELESS SIGNALLING. W. T. Ditcham & Grindell-Matthews Wireless Telephone Syndicate, Ltd. June 5th.

15,392. VAPOUR ELECTRIC DEVICES. British Thomson-Houston Co. (General Electric Co.). July 3rd.

15,658. ELECTRIC RAILWAYS. C. M. White (Sturges). July 7th.

15,682. ELECTRIC CONTROL OF ELECTRIC MOTORS. Otis Elevator Co. (Otis Elevator Co.) July 7th. (Patent of addition not granted.)

16,349. ELECTRICAL STOP MOTIONS FOR KNITTING MACHINES. G. Stibbe. July 16th.

16,601. APPARATUS FOR HEATING LIQUIDS ELECTRICALLY. British Electric Heater Co. & C. Kratt. July 19th. (Cognate application, 28,355/13.)

17,264. ELECTRIC OVENS AND THE LIKE APPLIANCES. M. Railing & G. H. Ide. July 28th.

18,024. WIRELESS APPARATUS. G. E. Heyl & T. T. Baker. August 7th.

18,073. ELECTRIC SHAFT FURNACES. W. N. Crafts. August 8th.

18,400. ELECTRIC LIGHT CEILING FITTING, FITTED WITH A SPECIAL DEVICE TO FACILITATE THE FITTING OR REMOVAL OF A GLASS OR ALABASTER BOWL OR METAL REFLECTOR, OR THE LIKE. A. Higgins & S. Griffiths. August 13th.

19,588. CONTINUOUS-CURRENT TRANSFORMERS. P. M. J. Boucherot. August 29th. (September 18th, 1912.)

19,757. RAILWAY SIGNALLING. H. W. Firth & F. W. Leake. September 1st.

21,140. REGENERATIVE BRAKING SYSTEMS FOR ELECTRIC MOTORS. N. W. Storer. September 18th. (October 5th, 1912.)

25,643. TELEPHONIC RECEIVING APPARATUS. Western Electric Co. (Woodward, acting for Western Electric Co.). November 10th.

26,251. ELECTRICAL ACCUMULATORS. H. C. Weeks. November 15th.

26,502. DYNAMO ELECTRICAL MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES AND LIGHTING SYSTEMS IN CONNECTION THEREWITH. L. J. Wolf. November 18th.

26,778. LAMPS OR HEAD LIGHTS. H. V. J. Jouffret. November 21st. (November 22nd, 1912.)

27,137. APPARATUS FOR RECORDING NUMBER OF TELEPHONE CALLS. A. J. Fitzgerald and E. G. Fitzgerald. November 25th.

29,270. COMMUTATION ARRANGEMENTS FOR ELECTRIC ROTARY CONVERTERS COUPLED TO ALTERNATING-CURRENT BOOSTERS. Siemens Bros. Dynamo Works, Ltd., & J. C. Wilson. December 18th.

29,831. MEASURING INSTRUMENTS FOR RONTGEN-RAYS. R. Furstenaü. December 27th.

1914.

72. PROCESS FOR RESTORING THE ACTIVITY OF A POSITIVE ELECTRODE MASS FOR ALKALINE ACCUMULATORS. Svenska Ackumulator Aktiebolaget Jungner. January 1st. (January 16th, 1913.)

1,640. ARRANGEMENTS FOR REGULATING THE TORQUE OF POLYPHASE ELECTRIC MOTORS. Siemens-Schuckertwerke Ges. January 21st. (January 22nd, 1913.)

3,818. THERMAL CONTACT DEVICE FOR ELECTRIC CIRCUITS. B. Jeidel, née Hendel. (February 13th. (December 5th, 1913.)

4,309. CONTROLLING OF ELECTRIC MOTORS FOR SHIP PROPULSION AND MEANS THEREFOR. Siemens-Schuckertwerke Ges. & F. Hulss. February 19th. (Divided application on 13,148/13. June 6th.)

6,454. ROTARY TRANSMISSION DYNAMOMETERS WITH RECORDING APPARATUS. M. Rockstroh. March 13th.

8,719. ELECTRIC HEATING AND COOKING DEVICES. R. Sprenger. April 6th. (April 7th, 1913.)

12,032. TESTING OF INSULATION. Evershed & Vignoles, Ltd., and S. Evershed. May 31st. (Divided application on 12,723/13. May 31st.)